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FOUNDED 1872

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DECEMBER 28, 1934

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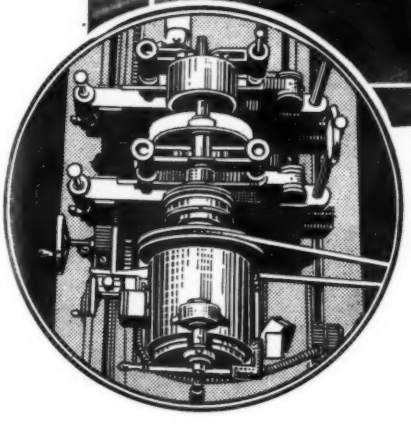

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The
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Problems of the Industry

THE electrical industry and trade of this country never have been free from problems. Does anybody expect that they ever will be? They are developing very rapidly, they consist of many diverse interests, and they are allied to many other branches of activity.

The questions raised have changed in number and in character from year to year. New developments necessarily produce new problems but some of the old ones cling tenaciously to life. The subject is therefore not an inappropriate one for the closing editorial comments of our one-hundred and fifteenth volume.

During the last year or two a much larger number of men and women have been taking a deep interest in matters; this may help us more speedily and effectively to settle differences and lay down lines of common policy, but it does not always do so.

This greater interest is demonstrated in these days by the plain speaking that one hears in general conversation, and as safety valves have admirable uses, the tendency is to be welcomed, especially when conversation is not merely casual, haphazard and irresponsible chatter.

What a lot might be written regarding the problems that are being talked about just now!

From the criticisms that reach us we judge that far greater things have been expected than seem to have been secured from last year's reorganisation of the Electrical Development Association.

Then there is the electrical contractor concerning whose future so many are expressing strong views. They hold that the position is changing, that the number of his kind carrying on installation work and trading without the imprimatur of registration is certainly not becoming less, and they assert very frankly that a profitable future cannot be guaranteed to the contractor.

The continued efforts to secure the adoption of a trading policy have brought up again most of the old arguments regarding discount rights and wrongs, the position of the ironmonger and of the municipality. Some men regard the prospects of successful application of the Policy with much misgiving. They recognise the strong bargaining position of the organised electricity supply authorities as installation contractors and sellers of domestic and other electrical equipment necessary to facilitate the electrification of homes and factories, boosting the national load at a more rapid rate. Will the New Year bring about some form of compromise between the various interests?

Two matters which have been widely discussed for years underwent change last autumn, decisions being reached which hold encouraging possibilities. We refer to the plans for the National Electrical Convention in June and the holding of a larger electrical market than usual at the British Industries Fair at Birmingham in May. The change of date for the Fair is an experiment and we must take measures to ensure that nothing is left undone to make it successful. The criticism that one has heard regarding this event has been the need for a stronger working committee. Of the Convention at Bournemouth the hope is heard that it will be so run as to produce a national electrical effect and benefit the entire industry.

Various other matters are the subject of conversation amongst electrical men but are seldom written about in the Press. It must not be imagined, for instance, that everybody regards with contentment our central electricity authorities and the policy which they have to carry out. Who could expect that they would do so?

They are not sacrosanct. True they may be regarded with holy awe, but originators of projects for the future, and other people too, consider their constitution a legitimate subject for discussion. The successive stages of co-ordination in respect of generation have passed; we are now facing our distribution obligations to the nation; and it is no rare view that the year 1935 may afford suitable opportunity for a certain co-ordination and strengthening of the control of the supply industry, so that from the top a more definite energising influence will flow down amongst all ranks. Leadership, it is thought, might with advantage be more strongly in evidence. But this is a criticism that has often been heard in the electrical industry.

A Hopeful Outlook

THE year that is closing leaves the electrical industry less cause for regret than a number that have preceded it. Certain special departments continued to labour under great difficulties, but are in more hopeful mood than they were, while others experienced most satisfactory revival and are enjoying a mild sort of boom as the period closes. The general consensus of opinion, as far as we are able to judge it, is that we may enter upon the New Year with steady confidence concerning the prospects. There seems to be a more widely spread spirit of determination to accelerate the rate of electrical development; there is no doubt of the existence of large scope both at Home and overseas. There is plenty of electrical work everywhere that ought to be done; the removal of trading obstacles, including a clearing up of international economic problems, would turn the intangible possibilities into actual contracts. Progress in this direction should materially assist the industry. Increased attention is being given to the chances of substantial railway electrification operations being proceeded with, but predictions have so often remained unfulfilled that caution controls a forecast, though the atmosphere seems to favour definite action being taken during the coming twelve months.

The Shildon-Newport Railway

THE closing down next month of the sixteen miles of electrified line on the L.N.E.R. between Shildon and Newport provides a significant commentary on conditions on the North-East Coast. Before the war Shildon was the marshalling point of the heavy mineral transport between the Durham coalfields and the iron and steel works on the Tees. Now the volume of traffic has shrunk to less than 15 per cent of what it was twenty years ago, and the bulk of the small residue will be carried direct to its destination, thus cutting out the Shildon marshalling yard. In our leader of June 2nd, 1916, we said that the scheme was the first real step towards the introduction into this country of electric traction for heavy goods, and mentioned the official statement to the effect that the scheme was experimental. The electric system is over eighteen years old, and so does not represent the latest practice, but the technical experience gained from its working has been considerable. That the change in traffic density has prevented economic operation during the past few years should not be regarded as a reason for holding up railway electrification in more prosperous districts.

Rural Supplies

THE Conference on Electricity Supply in Rural Areas held at the offices of the Electricity Commission took a good step in appointing a committee to consider what is the most appropriate form of tariff or tariffs for this class of load, which involves the difficult problem of dealing with isolated premises. Many undertakings have evolved schemes that appear to work well and to be acceptable to the farmer. The collection of the available information should be most helpful to others who have not had the same practical experience of the peculiar difficulties encountered. One of these is the question of meeting capital expenditure on connecting up. The undertaking desires a reasonable prospect of permanency for a special connection, while the farmer often expresses a doubt as to whether he will be in occupation long enough to obtain a return on a contribution.

Facilities and Limitations

IN their annual report (reviewed in this issue) the Electricity Commissioners show that since the publication in July, 1930 of the recommendations of the two committees on assisted wiring and apparatus hire and on tariffs, the number of undertakings offering reasonable facilities has increased by about one-third to two-thirds in the several categories. Although 83 per cent. of the undertakings quote two-part tariffs (as against 53 per cent. before the date mentioned) there has been no marked decrease in the anarchic mutliplicity of charges. There were still 115 authorities which were without assisted wiring schemes and 196 that offered no facilities for the hire of apparatus; it is for such that the much-talked-of reorganisation of distribution is designed. The report also lays it down that the I.E.E. Regulations cannot be imposed by undertakings as an inflexible standard and that such a provision would not be approved as a bylaw. Their retrospective bearing on the Commission's new Electricity Supply Regulations has been deferred by an official circular issued this week which substitutes "January 1st, 1936, or such other date as may be prescribed," for next Tuesday as the date of coming into force of the latter. This will leave time for several contentious points to be decided.

Leakage Trips

THE interest shown in the demonstration of low-current earth-leakage trips before the Association of Supervising Electrical Engineers was only to be expected having regard to the approval given to their use in the new edition of the I.E.E. Wiring Rules. The readiness of three British manufacturers to expose their productions to public criticism by Mr. T. C. Gilbert augurs well for their determination to provide the best apparatus for conditions in this country, in the rural areas of which, especially, they should find wide scope. The opinion of engineers as to how far the incorporation of all the features to be found in Continental models is desirable should be helpful, and operating experience on the lines of that given in the letter of Messrs. J. S. Pickles and D. Ross in our issue of December 7th, is especially useful. Is it essential, for instance, to provide protection on both poles? The additional cost of leakage trips (as compared with switches and fuses) will presumably be reduced with quantity production and with a higher degree of electrification, will form a much smaller proportion of the overall installation expenditure. Moreover, the elimination of fear of shock from the minds of consumers should provide a strong stimulus to a greater use of electricity.

No Miracles

As we have frequently remarked, to suggest that sensational price reductions can be brought about by the grid is likely to lead to futile criticism when it is found that the Central Electricity Board does no more than it was expected, or intended, to do. Politicians, in advocating rival electrical policies, were largely to blame for the ideas that were prevalent a few years ago, and now a London daily informs its readers that the Board has been instrumental in "slicing" the cost of electricity to residential consumers from 1s. per kWh to a mere fraction of a penny in one case. Within three or four years electricity will, it states, be available in the remotest villages, and the Board will tap the grid wherever there is a demand for current. The result of raising hopes of this kind is that the occupant of a remote farm whose land a grid line passes is annoyed if he cannot be supplied from it—and that at a mere fraction of a penny. He, and others also, may come to regard even the most progressive distribution undertakings as gross profiteers.

A Grid Broadcast

SOMETHING which we have long advocated and hoped for appeared in the London Regional programme of the B.B.C. on Thursday last week, when an item called "The Grid" was broadcast. Following a brief, well-staged explanation of the origin and construction of the grid, a working woman was heard expressing her longing for the "electric" which a relative had adopted with excellent results. Then there were glimpses of selected stations with appropriate comments, and listeners heard how the load in the South-East England area is controlled from Bankside and how preparations are made for meeting the heavy demand caused by fogs. Altogether it was a most interesting item and a most valuable piece of electrical propaganda.

Sub-station Maintenance.

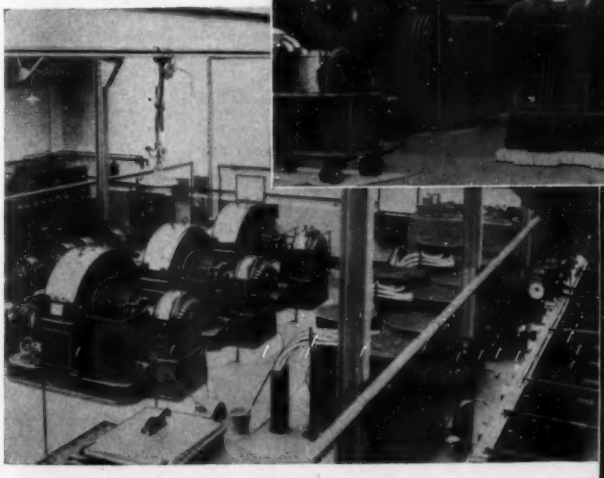
By F. C. Orchard, A.M.I.E.E.

Some inspections and tests for inclusion in the periodical overhaul

THE most important features in a sub-station are the protective relays and devices. These should be tested regularly, and if a definite schedule of overhauling and testing is drawn up it is unlikely that any part can be consistently forgotten. A.c. protective relays on h.v. feeder and transformer switchgear panels should be tested by passing low-voltage current through the instrument current-transformer primaries. In this way mistakes due to wrong re-connection of the wiring after testing are avoided; furthermore, the complete relay circuit is checked.

All h.v. circuit-breakers must be thoroughly examined and overhauled every six months and after each clearance under fault conditions. See that the contacts are clean and in correct alignment, and that the arcing tips make before and break after the main contacts. Do not use badly burned arcing tips, as renewing them is cheaper than fitting new main contacts at a later date. Inspect, clean and lubricate all toggles, links, hinges and interlocking features regularly. Renew the oil in the circuit-breaker tank every two years (if the operation of the breaker under load is frequent it may be wise to replace it at more frequent intervals).

After opening under a heavy fault, test the oil in accordance with B.S.S. 148 for dielectric strength and replace if necessary. When cleaning out the tanks use a non-fibrous material and swill out with clean oil before filling up with new oil. Keep the oil level in the tank to the mark registered by the maker. Clean all insulators, for sludge reduces the effective creepage distance. Replace the oil in the potential transformer chamber and in the current transformer every two years.



Left: A typical sub-station showing three 500-kW rotary convertors with single-phase air-blast transformers. The a.c. circuit-breaker control board is on the right of picture and the d.c. panels are on the left. Right: A more detailed view of the d.c. panels. Top: A 2,000-kW self-synchronising rotary convertor in a large sub-station. The starting panel is on the left in front of the transformers, and nearby is a centrifuge with heater elements

The Transformers

Transformers should have oil samples taken every year and the dielectric strength tested, while every two years the oil should be centrifuged. Maintain the oil at the correct level on the gauge glass. Where transformers are water-cooled more frequent sampling and inspection is advisable, and the thermometer readings must be noted at times of peak loading. Excessive temperature rise is nearly always due to corrosion in the cooling tubes.

To clean the tubes do not remove them from the tank but disconnect from the main supply and outlet pipes and fit some temporary rubber piping so that the coils may be filled and emptied as required. Remove all water from the tubes by blowing out or by syphoning, and then fill up with a solution of hydrochloric acid of a specific gravity of 1.10. This proportion may be judged quite easily, since it is a solution of equal parts of commercially pure concentrated acid *added* to water. After the solution has been in the tubes for about an hour drain off and flush out well with clean water. Do not block up the ends of the tubes while the solution is in the pipes because the chemical action is often violent. When copper coils are fitted these can be cleaned in the same manner and with the same solution.

Brush Inspection

Once each week the armature and brush gear of machines should be blown out with compressed air (at a pressure not greater than 25 lb. per sq. in.). Wipe over the commutator and the brush gear with a clean rag, never with cotton waste. Inspect the brushes and replace when necessary with the same grade and make of brush as fitted by the maker. Test the brush pressure and adjust to the value suitable to the service it performs. Contrary to expectation, the coefficient of friction varies inversely as the brush pressure is increased, so that excessive wear may be due to too little pressure on the brushes. On the other hand, too great a pressure increases the watts loss in the brush. Keep to the pressure recommended by the brush maker.

Never destroy the skin on a commutator unless the surface has become grooved or has been pitted in a flash-over. When the commutator needs attention use a shaped pumice stone. Incidentally, if there is not sufficient time to bed in new brushes by the usual laborious method, the use of a soft pumice on the commutator will do so perfectly in a very short time. After using a stone blow the machine out well and do not put on more than about 15 per cent. of load at first, and take at least three days in working up to full load. Commutators have been ruined by neglect of a working-in process. Maintain the oil level in the lubricators beneath the a.c. rings.

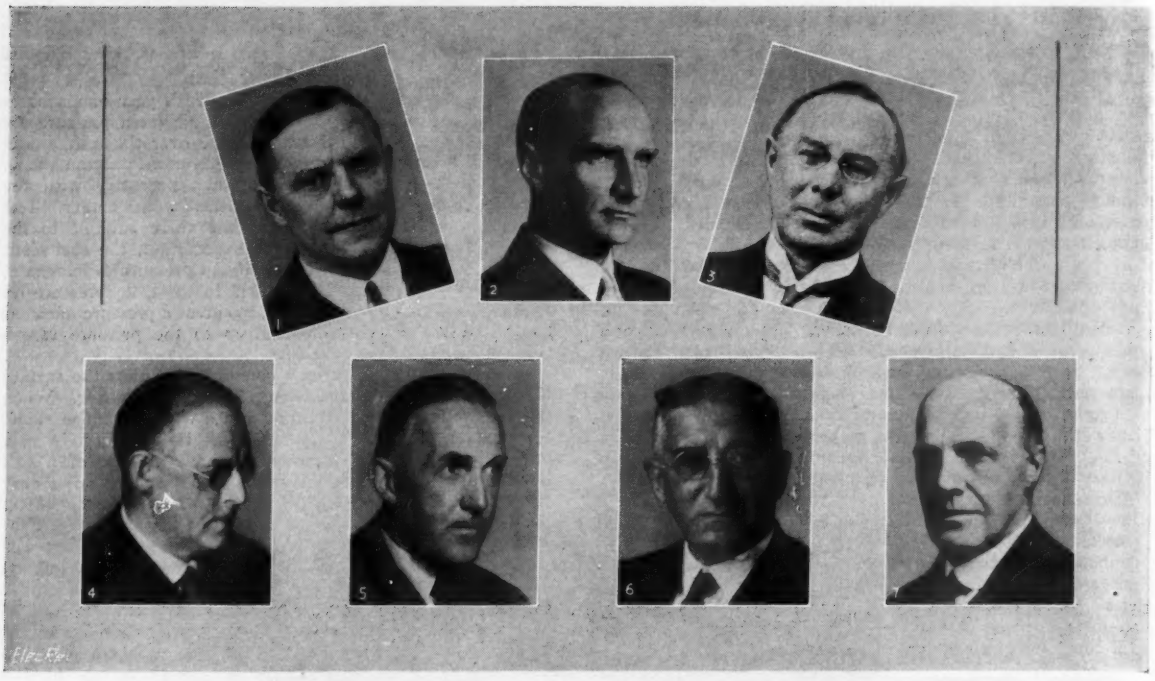
Renew the oil in the main bearings every twelve months, or more often with high-speed machines. During the weekly overhaul and cleaning a " megger " test must be made and the readings logged.

If a commutator has an even skin it is safe to assume that commutation is satisfactory, but if two or three of the segments are badly discoloured or burned the cause must be investigated at once. If the mica is not in need of undercutting or the segments concerned are not lower than the remainder, or the edges of the segments are not burred up, then it is a wise plan to take a drop test on the armature to see if there is a fault in the following way: First, lift all the brushes. Obtain a low-voltage (2 to 3 V) d.c. supply, *e.g.*, from a feeder booster, and then place two leads terminating in connectors on adjacent segments.

The current flowing through the circuit should be regulated so that it is sufficient to give a clear reading of the voltage drop in the windings. Maintaining the current at a constant value, measure by a milli-voltmeter the drop across each adjacent segment, *i.e.*, after each test move each connector one segment round so that each segment has the current passed through it twice. Across certain of the pairs of segments the drop will be lower than across others, due to the equaliser connections and slip-ring tappings.

(*Continued on next page.*)

The Electricity Commission



1. Mr. D. S. Cumberlege, Legal Adviser. 2. Mr. H. Nimmo, M.I.E.E. (*Elliott & Fry*), Chief Engineering Inspector. 3. Mr. R. T. G. French, O.B.E., Secretary. 4. Mr. T. P. Wilmshurst, M.B.E., M.I.E.E., Commissioner. 5. Mr. J. M. Kennedy, M.I.E.E. (*Davey & Johnson Taylor*), Commissioner. 6. Sir John F. C. Snell, G.B.E., M.Inst.C.E., M.I.E.E., Chairman. 7. Sir John R. Brooke, C.B. (*Autogravures*), Vice-Chairman.

Sub-station Maintenance *(continued from previous page)*

All the low readings should correspond in position round the commutator. A very high reading indicates a bad joint, and it may be localised by holding one voltmeter connector on the current-carrying segment and moving the other one half-way up the riser of the other current-carrying segment. With a normal reading this time it betrays a bad connection between the commutator riser and the segment. Hold the voltmeter connector on the current-carrying segment and make the other connector form a contact with the actual armature winding at the rear of the sweated clip joining the conductor to the riser. A normal reading here will indicate a bad joint between the armature conductor and the riser. Repeat this test, keeping stationary the voltmeter connector which was previously moved and moving the other connector to the various points mentioned. The bad joint can thus be tracked down and, when located, can be re-sweated, a test being made afterwards to see that the attention has had the desired effect.

The entrance to the Electricity Commission's headquarters, Savoy Court, London, W.C.2

There is one protective feature on a rotary which is frequently neglected, not only as regards cleaning but also testing, and that is the overspeed device. This should be dismantled every twelve months, washed with paraffin, dried, lubricated, reassembled and then tested. The test can be made by putting the machine on about 20 per cent. load and then tripping out on the a.c. side.

By operating the field regulator the speed can be adjusted as in the case of a plain d.c. motor and the tripping value of the overspeed device tested by increasing the speed while a tachometer is held on the end of the shaft. Do not allow the machine to attain a higher speed than about 20 per cent. above synchronism unless it has been designed for a special value. During the test be alert to trip the d.c. breakers if anything unusual is suspected. This is not a test to be undertaken by juniors; a senior engineer should always be present. The overspeed device is usually set to operate at 15 per cent. above the normal.

Reverse-current trips on the d.c. breakers should not be tested by reversing the machine out. It is much safer to change over the two leads from the shunt to the reverse-current relay and test the operation of the trip on forward current. Do not forget to change the connections again after the test has been completed.

If there is an interlocking circuit between the a.c. and the d.c. circuit-breakers it will be necessary to disconnect it when testing. After re-connection, test the operation of the apparatus by opening the oil-breaker and seeing that the d.c. breakers trip. In this test leave the machine isolators open on both the a.c. and the d.c. sides. Trip the overspeed device by hand again now and see that the d.c. breakers clear.

Keep the field regulators clean and the slider working freely. Test any alarm circuits used to call the operator's attention to an open breaker.

Test the air gap between the armature and the field-pole tips every two years. It is usual to make the gap a shade smaller at the top than at the bottom, so that in operation there is a tendency for the armature to float under magnetic attraction and so relieve the bearings of some of the weight. If the gap differs appreciably from that allowed in a new machine, then the bearing liners need replacing.

Ensuring a Satisfactory "Earth"

There is one item which is almost invariably neglected in all sub-stations, namely, the "earth." In all cases the resistance must be kept low if the plate is to be effective. A simple test can be made if there is a mains water supply into the sub-station. By connecting a source of a.c. energy to one terminal of the earth plate and the other terminal of the source to a bond on the water main, a voltmeter across the plate and the water-main bond will record the voltage drop in the circuit.

With an ammeter in the circuit the current flow can be measured and the resistance calculated in the usual way. The calculated resistance is then the value of the two electrodes in the circuit, but since the water-main earth has a resistance so low that it can be neglected, it follows that the value obtained is that of the station earth plate. For testing, a.c. is preferable to d.c., since errors due to electrolysis are avoided.

An easier method which has the advantage that it is direct reading, is not affected by stray earth currents or by electrolytic action and is quick, is by the use of a "Meg" earth tester.

The Central Electricity Board

AS has been announced already in the ELECTRICAL REVIEW, important changes are taking place as from January 1st, 1935, in the membership of the Central Electricity Board.

In February, 1927, the then Minister of Transport, Col. Wilfrid Ashley (now Lord Mount Temple) announced the appointment of Sir Andrew Duncan as chairman, and gave the names of the seven members. Five of these gentlemen are still members. They are Sir James Devonshire, K.B.E., M.I.E.E., who was closely concerned with electric power supply company interests; Mr. Frank Hodges, who was secretary to the International Miners' Federation; Alderman W. Walker, M.I.E.E., M.I.Mech.E., who was widely experienced in municipal electricity supply at Manchester and actively connected with National Joint Industrial Council and National Joint Board affairs; Sir Duncan Watson, then chairman of the London and Home Counties J.E.A. and possessing practical electricity supply experience; and Mr. W. K. Whigham, a director of the Bank of England and a member of the Trade Facilities Act Advisory Committees.

These have all been continuously in office under Sir Andrew Duncan's chairmanship since March 1st, 1927. Sir Ralph L. Wedgwood succeeded Sir James Lithgow, an original member, on his retirement in 1930.

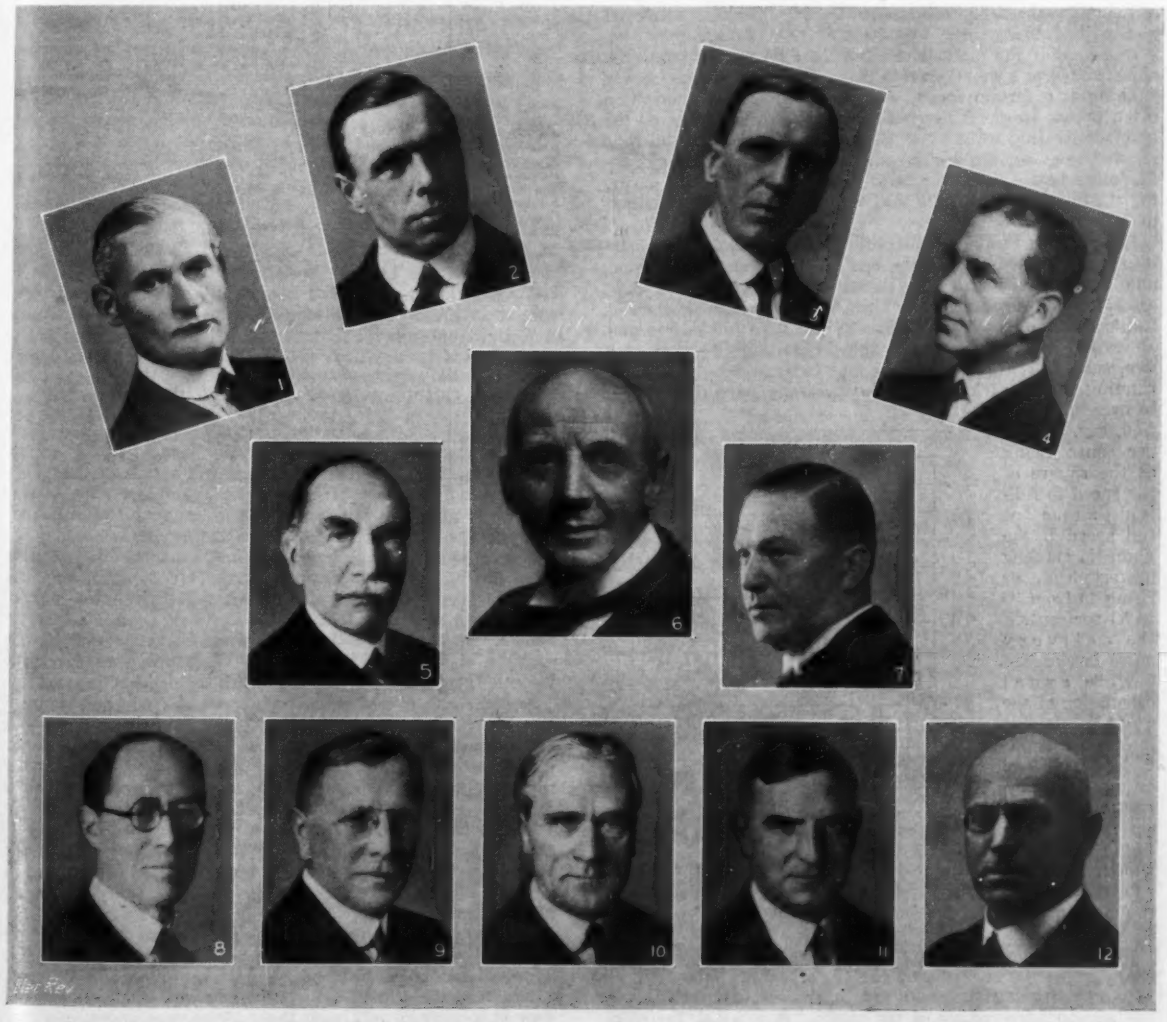
Next week Sir Andrew Duncan becomes an ordinary member instead of chairman and Sir Archibald Page, hitherto general manager to the Board, becomes its chairman. Lord Barnby is retiring, as we have already reported.

As the work of the Central Board is entering upon a new phase and its operations are likely to be of considerable importance during the coming year we are placing before our readers to-day a collection of photographs of the Board, as well as those of Mr. Johnstone Wright, the Chief Engineer, Mr. Harold Hobson, the Commercial Manager, Mr. D. W. Coates, C.B.E., the Chief Accountant, and Mr. Richard H. Fox, the Secretary and Solicitor.

On the opposite page we also place before our readers portraits of the Chairman, Vice-chairman and members of the Electricity Commission and its chief officers. In February, 1920, the then Minister of Transport appointed Sir John F. C. Snell to be chairman, and Messrs. H. Booth, Mr. W. W. Lackie, C.B.E., and Mr. (now Sir) Archibald Page, to be Commissioners. As recently stated here, Mr. Lackie resigned his office in July last and Sir Archibald Page left the Commission in 1925. He later became chief engineer and manager of the Central Board, subsequently taking the position of manager and now that of chairman. Mr. J. M. Kennedy, O.B.E., was appointed chief technical member of the Commission, when Mr. Lackie retired upon reaching the age limit.

The headquarters of the Central Electricity Board, Trafalgar Buildings, Charing Cross

The publication of these portrait groups is timely by reason of the fact that the new Electricity Bill has just passed its final stages in the House of Commons and has been introduced into the House of Lords.



1. Mr. H. Hobson (*Lafayette*), Commercial Manager. 2. Mr. D. W. Coates, C.B.E., Chief Accountant. 3. Mr. Johnstone Wright, M.I.E.E., Chief Engineer. 4. Mr. R. H. Fox, Secretary and Solicitor. 5. Sir James Devonshire, K.B.E., M.I.E.E. 6. Sir Archibald Page, M.I.E.E., Chairman. 7. Sir Andrew R. Duncan. 8. Sir Ralph L. Wedgwood, C.B., C.M.G. 9. Mr. W. K. Whigham. 10. Sir Duncan Watson. 11. Mr. Frank Hodges. 12. Ald. W. Walker. (*Photos. Nos. 2 and 4 to 11 by Elliott & Fry.*)

Starter Duties. By R. Davies

Nature of the service required with various types of drive

WHILE information on the power required to drive machines is available in many well-known publications, the characteristics of the starting period in any particular application have not been given the same amount of prominence. In the case of a.c. motor equipments this question is of greater importance than with d.c. drives on account of the numerous types of motor available, each of which possesses its own peculiar starting features.

Motor-driven equipments may be classified as: Light starting, practically no load (*e.g.*, motor driving on to a loose pulley); dynamo drive, torque varies directly as the speed (*e.g.*, motor-generator set); fan load, torque varies as the square of the speed (*e.g.*, ventilating fans and centrifugal pumps); brake load, constant torque (*e.g.*, ram pump and air compressor); or flywheel load, maximum torque at starting (*e.g.*, hydro-extractors and machines fitted with a flywheel).

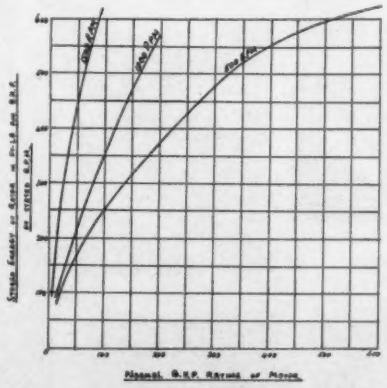
These are, briefly, the extreme conditions of starting duty, independent of the normal load rating of the motor. It is, however, equally as important carefully to consider conditions which arise during the starting period as those existing when the motor is finally operating under load. In view of the ambiguity which appears to exist with regard to the meaning of the three component torques involved, the following definitions are given.

Types of Torque

The starting torque is the force required to move the motor from rest, *i.e.*, the effort necessary to overcome static friction, which, in certain circumstances, may be considerably in excess of the accelerating and normal running torques. This varies according to local circumstances, and should therefore be liberally estimated in view of the standstill torque available at the motor shaft, depending upon the type of motor employed and method of starting.

Immediately the motor has started the torque automatically adjusts itself to a value equal to that required to produce steady running at a certain speed, to increase which the application of an excess torque is necessitated. The latter represents the true accelerating torque and its value depends upon the time allowed to attain the desired speed. In other words, it is the difference between the torque developed by the motor during the starting period and the load torque which is in opposition to it.

The running torque is generally the effort required to maintain normal full speed at the end of the accelerating period, and is practically constant throughout this period in most cases. It has not necessarily any connection with the normal full load of the motor, and is usually less than full-load torque. However, many exceptions to the general rule exist in practice, such as centrifugal pumps and fans, in which cases the running torque at low speed is practically only that needed to overcome friction, say, 5 to 10 per cent., rising as the square of the speed to full-load torque at full speed if the pump is starting against load, or rising to from 30 to 50 per cent. if the delivery valve is closed.



Approximate stored energy to be anticipated in the rotor at various speeds

While exact calculation of the static starting torque is difficult, it is possible to estimate with reasonable accuracy the accelerating torque, which, after all, is the most important of the three components mentioned. It depends entirely upon the inertia of the moving parts and the time in which it is required to run the motor up to speed.

From the point of view of starter design it is convenient to consider inertia in terms of foot-lb. of energy stored in the moving parts at full speed, and to express this relatively to the normal horse power of the motor. It is usual, therefore, to state the stored energy in terms of foot-lb. per motor brake-horse-power.

The moving parts of an equipment can be conveniently considered as made up of two items, *i.e.*, the rotor of the motor and the plant it drives. The accompanying curves give an approximate idea of the stored energy to be anticipated in the rotor at various speeds, to which should be added the stored energy detailed in the table for the particular equipment in question. This will give the total stored energy, from which the time required to accelerate can be obtained from the following formula: $A=S/2.75\times T$ where A=accelerating time in seconds; S=stored energy in ft.-lb. per b.h.p. at full speed; and T=percentage of full-load motor torque available for acceleration.

The typical examples illustrating the relative values of the information given in the curves and table are represented by the hoisting motor of a crane and colliery winders. The stored energy of the crane motor is the main item to be considered, because, due to the comparatively low hoisting speeds, the stored energy of the load is practically negligible. On the other hand, when the hoisting speeds are high as in the case of colliery winders, the stored energy in the load, cages, rope, &c., is so great that the stored energy of the rotor becomes a negligible percentage of the total. Similarly, in such drives as hydro-extractors, high speed saws and rolling mills the rotor stored energy forms only a small percentage of the total, and can generally be ignored.

FRICTION TORQUE AND STORED ENERGY FOR VARIOUS CLASSES OF MACHINERY

Description of Drive.	Friction or load torque at end of accelerating period.	Stored energy at full speed.
	Per cent.	ft.-lb./b.h.p.
Toothed gears	—	15/18
Loose pulley	2½	As from accompanying graph.
Shop line shafting	20/80 aver. 45	800/1,000
Hoisting full load on cranes	80/100	6/7
Hoisting f.l. colliery winders	100	500/1,000
Small rolls and bar bending machines	10	700/1,000
Medium punching machines	10/15	2,000
Medium shearing machines	10/15	3,000/3,500
Large shearing machines	10/15	14,000/18,000
Large rolling mills	5/10/15	500/1,000
	5/10	2,000/3,000
	10/20	5,000/8,000
	15/20	18,000/65,000
Planing machines	20/40	7,000/10,000
Disc saws for wood	20/50	1,900/3,800
Band saws for wood	7½	2,500/10,000
High speed disc saws for steel	7½ at start, up to 20 at full speed.	14,000/17,000
Travelling motion of crane with f.l.	75/100	400
Centrifugal hydro-extractor	35/50 at start, up to 75/100 at full speed.	60,000/80,000
Centrifugal pump, valve closed	5/7½ at start, up to 30/50 at full speed.	As from accompanying graph.
Centrifugal pump, valve open	5/7½ at start, up to 100 at full speed.	As from accompanying graph.
Ram pump delivery against vertical head or accumulator	100	100/200
Air compressor, without by-pass	100	100/200
Air compressor, with by-pass	15/20	100/200
Haulage, clutches out	7½/12½	300/900
Haulage, clutches in	100	1,000/2,000
Conveyor	100	850/1,000
Rubber pulping mill	2½	50/60
Corn grinding mill	100	7,500
Lathes and drills	20/25	300

Misused Terms

Light and heavy starting duty are terms frequently misused; it is important, therefore, that full details of the equipment and the nature of the service required of the starter should be placed in the hands of the designer if satisfactory operation is to be ensured. A ventilating fan with long air passages presents a different problem from a normal fan drive as, if the fan is brought up to speed quickly, it will be running at full speed before the air pressure has risen to its final value, with the result that the motor will be seriously overloaded. In such cases the motor must be accelerated slowly, and the starter rated accordingly. The same remarks apply to centrifugal pumps if they start with the delivery pipe empty.

Another case is that of the high speed saw which, because it can be easily turned by hand, is considered light duty. It takes about 60 sec. to run up to speed with a constant accelerating torque of 100 per cent., so that the torque at starting must be 107.5 per cent. and at the end 120 per cent., which is anything but light. A further example is the hydro-extractor, which is probably one of the most onerous duties relatively to the motor size. The starting torque is exceptionally high and the accelerating period lengthy, but as soon as full speed is reached the power required to maintain rotation is considerably reduced.

From what I have said it will be appreciated that reasonable care and thought is required in selecting the most suitable type of motor and method of starting to be adopted, particularly in the case of a.c. equipments and that, whereas the user is concerned only with the performance under load conditions, the starter designer must consider the most suitable method of bringing the equipment up to the load conditions and provide the necessary protection under both conditions.

The Torque of an Electrical Machine

By Edward Hughes, D.Sc., M.I.E.E.

IN text-books dealing with the torque of an electrical machine the expression for the torque is based upon the well-known *Hli* formula for the force on a conductor carrying a current in a magnetic field, the authors ignoring the fact that the force on a conductor in a slotted armature is practically nil. Also it is customary for the resultant flux (or, more correctly the flux due to the resultant m.m.f.) to be shown passing radially across the gap between the armature and the pole face. Such a flux in the gap could not give rise to any tangential force on the armature. Further, if the torque were due to the kind of flux distortion usually shown, why should a machine still exert the same torque after being fitted with a compensating winding to prevent that distortion?

When the problem is examined more closely it is found easier to explain and to calculate the torque exerted by a machine fitted with a compensating winding than that of a machine without such a winding. Fig. 1 shows a pole pitch

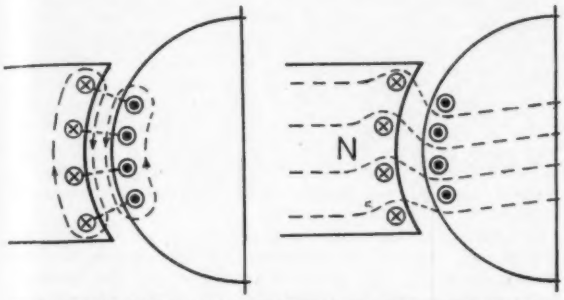


Fig. 1.—Pole pitch of a machine fitted with compensating winding. Fig. 2 shows the effect of cross-flux

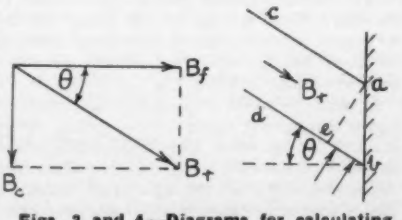
of a machine fitted with a compensating winding. For simplicity it is assumed that the current per conductor is the same in the armature and compensating windings; consequently, the number of conductors on the pole shoe will be the same as that on the portion of the armature that is opposite the pole arc. Also the slots are shown as if they were totally enclosed, since the degree of enclosure does not affect the discussion so long as the conductors are embedded in slots.

Since the currents in the two windings are in opposite directions the conductors may be regarded as forming a solenoid, as indicated by the dotted radial lines in fig. 1. This solenoid has a long, narrow air core, and the reluctance of the return paths through the pole and armature is negligible in comparison with that of the gap. Consequently, the density of the cross-flux in the gap is practically uniform and is given by $4\pi IT/10l$, where I is the current per conductor, T the number of conductors per pole on the compensating winding, and l the approximate length of the pole arc.

The effect of this cross-flux upon the resultant flux is shown in fig. 2, from which it will be seen that the torque is due to the magnetic field in the airgap having a component tangential to the armature.

A Discrepancy

Taking B_c in fig. 3 as the density of the cross-flux in the airgap and B_f as that of the radial flux due to the field winding alone, then B_r represents the resultant density and θ the angle between the resultant and the normal to the armature surface. Let us consider a length *ab* (fig. 4) on the armature periphery, and suppose *ac* and *bd* to be two planes parallel to the resultant gap flux. The tension along the lines of force is $1/8\pi\ B_r^2 \times ac \times$ length of armature core—that is, $1/8\pi\ B_r^2 A \cos\theta$, where *ac* is perpendicular to *bd*, and A is the surface area enclosed by *ab* and the axial length of the core. The tangential component of this tension is $1/8\pi\ B_r^2 A \cos\theta \sin\theta$. But from fig. 3 $B_r \cos\theta = B_f$ and $B_r \sin\theta = B_c$; hence the tangential force becomes $A/8\pi\ B_f B_c$.



Figs. 3 and 4.—Diagrams for calculating tangential force

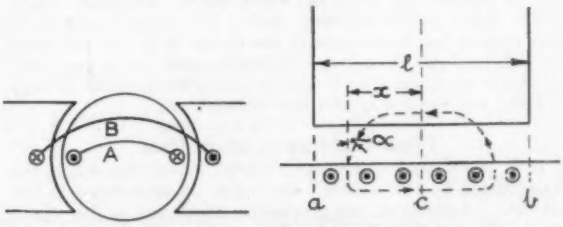
If Z is the total number of conductors on the armature, p the pairs of poles, D and L the diameter and length respectively of the armature core, then

Number of armature conductors opposite pole face $= T = Z \times l/\pi l$) and tangential force per pole $= LI/8\pi \times B_f B_c = LIB_f/8\pi \times 4\pi I/10l \times ZI/\pi D = \Phi IZ/20\pi D$, where Φ = flux per pole due to field excitation. Therefore, the torque on the armature $= \Phi IZ/20\pi D \times 2p \times D/2 = \Phi IZp/20\pi$ dyne-cm., which is only half the value derived from the *Hli* formula.

Dr. E. Hughes [*Lafayette*

The explanation of this discrepancy is dependent upon a fact that is never referred to in text-books on electrical engineering—namely, that for a magnetic field in air or other non-magnetic medium there is, in addition to the tensile stress of $B^2/8\pi$ along the lines of force a lateral compressional stress of $B^2/8\pi$ dynes. The proof of this expression is highly mathematical and may be found in such treatises as those of Maxwell and J. J. Thomson, and the phenomenon is referred to by Hague in his "Electromagnetic Problems."

The arrows perpendicular to *be* in fig. 4 indicate the direction of the compression on the lines of force, and it will now be shown that this compression is responsible for half the torque on the armature. The total pressure on a surface of width *be* and length L is $B_r^2/8\pi \times be \times L$—namely, $B_r^2/8\pi \times L \times ba \sin\theta$, and the component of this force in the tangential direction is $B_r^2 A/8\pi \sin\theta \cos\theta$, which is the same value numerically as that due to the tension along the lines of force. Consequently, the total tangential force acting on the armature is $B_r^2 A/4\pi \sin\theta\cos\theta$, and the total torque on the armature is $\Phi IZp/10\pi$ dyne-cm.



Figs. 5 and 6 are in respect of a machine without a compensating winding

It will therefore be seen that the torque on an armature is really a "push-pull" phenomenon, the "push" being due to the compressional stress at right angles to the lines of force, and the "pull" being due to the tensile stress in them.

The point to consider now is the effect of the removal of the compensating winding upon the torque. One might say that if two coils A and B are situated as in fig. 5 and carrying currents in directions shown, there is no torque on the armature, and consequently the removal of the fixed winding B cannot affect the torque due to the interaction of A and the field excitation. This reply, however, evades the difficulty and does not help us to visualise the manner in which the torque is produced in the ordinary machine.

If the reluctance of the armature core and teeth be neglected, the m.m.f. available to send the cross-flux from *a* via the two gaps and the pole shoe to *b* in fig. 6 is $4\pi IT/10$, the symbols being the same as those employed earlier. This m.m.f. decreases uniformly to zero at *c*; consequently the magnetising force available along the surface of the armature is $4\pi IT/10l$, as before. Thus the cross-flux is not radial, as usually indicated in text-books, but skewed somewhat (see fig. 6).

If B_x is the corresponding density of the cross-flux at a distance x from *c*, ∞ the angle between this flux and the normal to the surface, and B_f the density of the radial flux due to the field excitation, then the resultant radial density at a point x cm. on one side of *c* is $(B_f + B_x \cos\alpha)$, and at the same distance on the other side of *c* it is $(B_f - B_x \cos\alpha)$. The tangential component of the flux density is $B_x \sin\alpha$, and is given numerically by $4\pi IT/10l$. Using the same argument as that derived for the machine fitted with a compensating winding, it follows that the total tangential force due to peripheral widths dx, x cm. on each side of *c*, is $L.dx/4\pi \times B_x \sin\alpha \left\{ (B_f + B_x \cos\alpha) + (B_f - B_x \cos\alpha) \right\}$, namely, $IT/10l \times 2B_f \times L.dx$ dynes. Hence, total tangential force per pole $= IT/10l \times 2B_f \times L \int_0^{l/2} dx = IZ\Phi/10\pi D$ dynes, which is the same as that for a machine fitted with a compensating winding.

Electricity in the Miner's Home. By G. E. Watts

Load building under difficult conditions

DURING this age of domestic electrification and intensive energy-selling campaigns, it may be of interest to note the stages in load building as they frequently occur in a coal-miner's home, from the introduction of electricity for lighting to its subsequent use for general purposes. In this article, the conditions referred to are those actually to be found in the area of a small supply undertaking in a colliery district, which purchases supply in bulk.

It is not difficult to introduce electric lighting into the miner's house; in fact, the majority of miners make application themselves without the promptings of a canvasser. It has to be appreciated, however, that cash payment for the lighting installation is out of the question. The gas authority supplies an installation "free"; therefore to compete with any chance of success the electricity undertaking must do likewise. A clear explanation is made to the consumer that the installation is really on hire-purchase, and that 2d. per kWh is added to the flat rate to defray the cost. With a flat rate of 7d. this makes the price per kWh 9d. The poverty of the consumer does serve one good purpose; it ensures a first-class installation, whereas, had the consumer the means of purchasing the wiring outright, there is no doubt that in the majority of cases a "jerry" wireman would be called in.

A penny-in-the-slot meter has been found, by experience, to be far more satisfactory that the shilling type, for several reasons. One is, that at this high unit rate, the quantity of light per coin is easily checked by the consumer who is thus assured that value for money is being obtained. Another is, that in many cases there are lodgers or adult sons and daughters in the house, and these, when left to their own resources, object to putting in a large coin for the benefit of the landlord or parents—or *vice versa*.

The consumer obtains approximately 2¾ hours' light for one coin with a 40-W lamp in circuit. Only lamps of this size are fitted and the points are limited to four, as it is considered that the extra revenue which would be received would not be sufficient to cover the extra cost of additional points which would be infrequently used. The miner's wife finds that it costs her somewhere in the region of 1s. 9d. per week for lighting, and even if she has had experience of gas lighting she is not dissatisfied when she considers her clean ceilings and the convenience of the new system.

From Lighting to Other Uses

Then there comes the day, almost inevitable, when the hire-purchased "all mains" set makes its appearance in the kitchen. A two-way lampholder is fitted and a flex slung across the room to the set. The weekly bill for electricity rises to about 4s. per week. The supply authority soon has its first intimation of an additional appliance in circuit when the consumer complains of insufficient light for one penny. The service meter man soon locates the trouble, and equipped with his standing instructions, he advises the consumer of the two-part tariff, which consists of a fixed charge based on the rateable value of the house plus a running charge of ¾d. per kWh. The undertaking insists on a minimum of 1 kW of apparatus for this tariff, which condition is usually fulfilled by hiring a kettle and an iron. The rateable-value fixed charge for a consumer of the type in question is always the minimum one of 10s. per quarter; the h.p. charge for the four lights and an extra 5-A plug is 5s. per quarter; and the hire of the kettle and iron makes a total quarterly fixed charge of 18s. This works out at 1s. 5½d. per week.

It is found that in the majority of cases of this type the consumer prefers a prepayment meter, which incidentally meets the requirements of the supply authority where a consumer is hire-purchasing the installation. A penny extra per week is levied for the meter which embodies the synchronous motor for running off the fixed charge. A half hour's non-technical explanation of the *modus operandi* of this type of meter will be justified in the equability of the consumer when the switch happens to trip out during the night. The obvious economical advantage of the tariff will usually be appreciated. For the same consumption of energy as previously the consumer will now pay approximately 1s. 11d. as compared with 4s. per week.

The kettle and iron are the "sprats" and generally speaking it does not take long to land the "mackerel." The iron, of course, is a cheap luxury; ¾d. per week will usually pay for the energy consumed. The good wife soon finds that the kettle is ideal for use in conjunction with the fire for the very early morning meal when the husband is either going to, or returning from work; once used its convenience is realised, and ¼d. for boiling three pints is not considered exorbitant.

In addition to his wages, a miner is allowed a free quantity of coal, the amount depending on the number of shifts worked. Usually this quota is insufficient for the complete needs of the household. After a period of time has elapsed, sufficient for the consumer to become reasonably electrically minded, it is good policy for a canvasser to call. It can be pointed out that whereas the total annual quota of free coal might be sufficient for the winter months, it is not economical to purchase additional coal for the summer cooking.

Assuming that the fire has to be lighted and kept alight only for a length of time sufficient to cook one meal a day, the cost of the coal used during the summer months would be more than the annual hire charge on a medium-sized cooker plus its running costs for the summer months. A telling point is the fact that a cool kitchen will result from summer cooking by electricity. The deal can often be clinched by the offer of a month's free trial of the cooker. A reasonably intelligent person sees the force of this argument, and there is found to be a fair percentage of "mackerel" landed for the "sprats" cast.

The weekly costs will now be approximately 1s. 11d. during the winter months and 3s. during the warm period. The annual consumption averages out at about 500 kWh. Apart from the actual present consumption, the satisfaction of the consumer in this time of depression in the coal-mining industry is an excellent augury for electrical progress when prosperity is restored.

New Lighting at the Connaught Rooms

IMPORTANT structural alterations have recently been carried out at the Connaught Rooms in Great Queen Street, W.C., and a complete new illumination scheme has been put into operation, providing one of the most up-to-date and extensive lighting installations in the country. Etched amber or pink flashed opal glassware is incorporated in most of the lighting fittings, and devices with cast metalwork finished in gilt or bronze colour harmonise with the furnishings of the various rooms. Illustrations appear on page 897.

The Grand Hall is probably the best-known apartment. The Balmoral Room adjoins it, and when the two rooms are converted into one, as many as 1,700 people can be accommodated at a single banquet. The lighting scheme in the Grand Hall consists of a number of wall brackets wired on two (primary and secondary) circuits, a finely interpreted system of concealed lighting, and several decorative illuminated laylights and windows. The Balmoral Room has a neat system of wall-bracket illumination carried out with etched glass octagonally shaped units incorporating solid cast metalwork, each unit accommodating three lamps wired on two circuits. This system is supplemented by a number of laylights forming part of the ceiling panels. The wall brackets harmonise well with the decorative treatment. The foyer is illuminated by pendant fittings.

The illumination of the main entrance, vestibule, and stairs leading to the Grand Hall are illuminated by four pendant fittings of imposing design. On the first floor the Kent and York Rooms are illuminated by pendant fittings supplemented by wall brackets. The new foyers on the first and second floors, and the Ulster, Essex, Devon, and Stafford Rooms on the third floor, are lighted by hexagonal ceiling pendants incorporating amber flashed opal glassware and cast metalwork. All these fittings are wired on two circuits to provide utility and occasional lighting.

A large number of special brackets for mirror mounting figure throughout many of the special rooms mentioned, and bracket fittings with delicately etched glassware are installed in many of the retiring rooms, and these with the main lighting units create an atmosphere of dignity as well as luxury. The schemes for the various landings and corridors on the upper floors employ neat types of ceiling units, some of which are picturesquely etched with clear glass designs.

The American bar is a finely laid out apartment in which the lighting has been designed to incorporate a series of neatly fashioned and unobtrusive ceiling and wall fittings. In the various cloakrooms there is a special method of mirror illumination. Upwards of 4,000 Osram lamps are used throughout the buildings. The various lighting fittings were designed and manufactured by the General Electric Co., Ltd., and installed by Messrs. Troughton & Young, Ltd., the consulting engineers being Messrs. Ridge & Aldred. Messrs. H. V. Ashley & Winton Newman were the architects.

Electrolysis of Telephone Cables. By W. G. G.

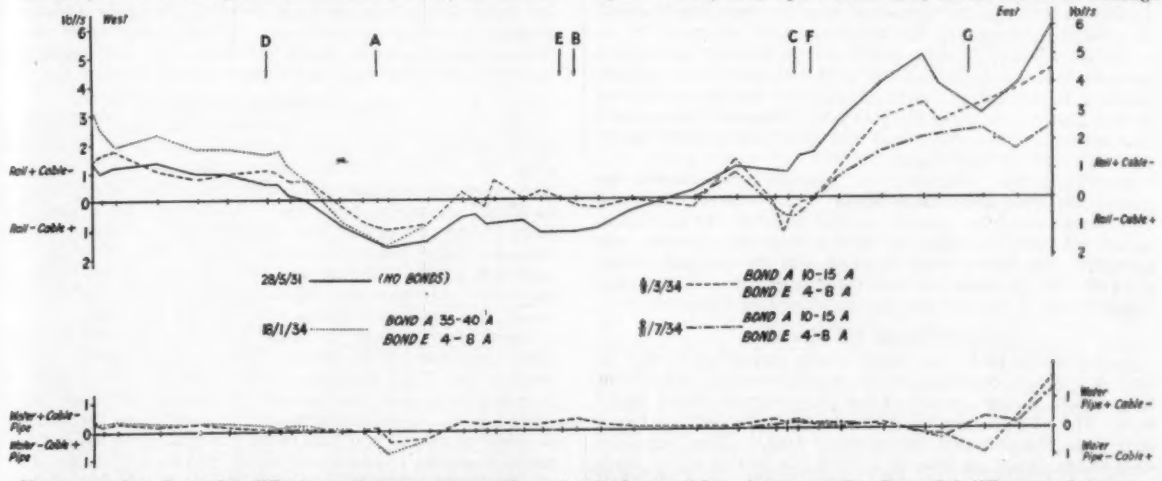
Experiences in Hong Kong

THE effect of tramways return currents in promoting electrolysis in telephone cables is well illustrated in the city of Victoria, Hong Kong. Victoria is built on the lower slopes of a hillside overlooking the harbour. The local public services are almost entirely confined to one long east-west strip and are usually in close proximity and more or less parallel.

The Tramway Company's route is about 8¼ miles in length with one short branch. Power is supplied by an overhead trolley system fed at 550 V d.c. in half-mile sections. The rails are bonded throughout. The track is laid on a concrete foundation and the road paving adjacent to the rails is, for the most part, granite setts run in with cement. There are parts where the road surfacing of 2-in. sand carpet on a concrete bed is laid right up to the rails.

Being within the tropics Hong Kong has a high winter-summer temperature range, so that due to expansion and contraction and to vibration the rails are rarely solid with the pavings, but soon become free to move slightly, and in wet weather are lying in water. A negative feeder cable is laid underground alongside the track and is connected to the rails at half-mile intervals. The Electricity Regulations in Britain allow a potential drop of 7 V from the far end of a system to the power station. It is understood that the Hong Kong Tramway Company is within this limit.

In 1931, when electrolysis first become evident, there were two stations supplying power to the system at points "A" and "B" on the accompanying diagram. "A's" average load was 450 A and "B's" was 500 A. An emergency third station at "D" was used on one day per month. The tramway traffic load in Hong Kong is very evenly distributed throughout the working day and there are no "rush-hour" peaks.



Upper graphs: Potential differences between tram rails and telephone cables. Lower graphs: Potential differences between water pipes and telephone cables

The Hong Kong Electric Co.'s main power and lighting services are all a.c. cables, with paper insulation. Some are lead covered and others are bitumen cables; all are armoured and laid direct in the ground. Where d.c. power is required for lifts, &c., it is supplied from convertors at power station "A" in the immediate vicinity of the required load, so that there are no long d.c. mains.

The water services are generally in good condition. Some of the older mains are known to be leaky and the soil surrounding them is waterlogged, but they are gradually being replaced.

How the Cables are Laid

The main conduit routes of the Telephone Co.'s cables are at no place distant more than a few yards from the tramway track. The older ducts are of fibre made from bitumen paper and the nest of ducts is encased in a concrete shell. Another route is a glazed earthenware multiple-way conduit, and the later routes are made of spun cement pipes with waterproofed joints. There are also several short sections of steel pipe.

The far-eastern section of the city is served with steel tape armoured cables laid direct in the ground and the same type of cable is used for branch cable work throughout the system. Much of the ground through which conduits are laid is made up or reclaimed and small subsidences are frequent. It has been found that with the earthenware multiple-way conduit a waterproof joint is practically impossible, so that water is always present to a certain extent in ducts and manholes. The paper fibre ducts have shown a tendency to buckle in their concrete casing, probably due to dampness having expanded the fibre. The spun cement duct appears to be more satisfactory, especially if laid with a slight fall so as to drain into the manholes.

The first cable faults definitely proved to be due to electrolysis occurred in May, 1931, and a general survey of the position was made. Readings were taken with a voltmeter between tram rails and cable sheathings at intervals along the whole route and the results were plotted. (See the full line on the graph dated 28.5.31.) At the far ends of the track the rails were positive to the cables, *i.e.*, it was in these areas that current was leaking from the rails *via* the earth to the telephone cables; the latter thus formed a shunted circuit to the tramways' negative system. In the central districts, near the power stations, the rails were negative to the cables, *i.e.*, current was flowing *from* the cable sheathing, thus setting up all the conditions in which electrolytic corrosion could occur.

Insulated Sheathing Joints not Practicable

It has been suggested that insulated joints in the sheathing of telephone cables would effectually break the circuit of these stray currents along the cables, especially if situated at the neutral point between the positive and negative areas. The making of such joints would be difficult and their reliability questionable, but, apart from this, there would be leakage through the earth around the joints, with the soil continually or even occasionally damp, and electrolytic action would be even more severe because the current flow along the cables is densest at these neutral points.

At this stage arrangements were made for the whole tramway system to be shut down momentarily. The current flow between the rails and cable ceased.

During 1931 and 1932 there were four cases of large cable faults through electrolytic action:—

(1) 18.5.31: 800-pair l.c. cable in fibre duct, about six years old, distance from rail to cable about 8 yd.

(2) 17.8.31: 400-pair l.c. cable in fibre duct, about twenty-two years old, distance from rail to cable about 100 yd.

(3) 19.10.31: 800-pair l.c. cable in fibre duct, about six years old, distance from rail to cable about 8 yd.

(4) 17.5.32: 600-pair l.c. cable in six-way earthenware duct, about five years old, distance from rail to cable about 50 yd.

In cases (2) and (4) the cables affected were some distance from the tram track. The ground was reclaimed and filled in and, being practically at sea level, it is always wet. Within a few feet of the telephone cables there are large water mains which, together with the cables, approach to within a yard or so of the tramway track, again about half a mile east and west of where the damage occurred, thus forming more parallel circuits for the stray currents, with potential differences between the cable and water main.

In most cases of corrosion the cable sheathing was attacked on the under side, *i.e.*, where it would probably be lying in water. Generally the pitting was in small spots, but in some cases the action had extended for some yards and varied from steep-sided pits to long patches, filled with a grey powdery deposit.

The first step taken to cure the trouble was to install as many earthplates as possible along the telephone cable route through the positive, or danger, area, the idea being to dissi-

pate the current at these earthplates rather than from the cable sheathing, but, owing to the difficulty in obtaining a good earth contact, little or no improvement resulted.

Experiments were next made in bonding the rail and cables at points near the supply stations, and bonds were connected at points "A" and "E." The "A" bond was found to be carrying up to 80 A. This markedly decreased the potential differences between the rail and cable in the danger area and also reduced the area's extent; but in the far-western area the decreased resistance of the leakage or "shunted" circuit increased the readings considerably. It was considered that 80 A was too heavy a load to drain through the lead sheathing, so a suitable resistance was inserted in the bond until the drainage figure became 35 to 40 A. A new set of readings was made and plotted (see the dotted line in the graph, dated 18.1.34). The "E" bond had no resistance in circuit and drained 4 to 8 A.

With a view to levelling out the load and thereby reducing the potential differences, the Tramway Company brought a new power supply into operation at point "C," and a bond was connected at point "F," which was the nearest point where the telephone cables were conveniently placed for bonding. This third bond occasionally worked the wrong way and was, therefore, dispensed with. Road alterations will shortly be taking place near here and it will be possible to install a rail-cable bond at a point much nearer the power supply than is point "F." The load as divided between the three power supply points was now "A" 400 A, "B" 300 A, "C" 250 A.

Bonds installed as above should be fitted with fuses, as an accidental break in the tramways' negative cable would result in excessive currents in the telephone cable sheaths.

The installation of these bonds served another useful purpose, in that the Telephone Co.'s cables now became slightly negative to the general earth throughout the system, except at two places, but there the potential differences are so small that action between the cables and other services and structures can only be very slight.

Meanwhile the Telephone Co. completely overhauled its routes. In manholes, cable joints were remade above the duct levels wherever possible so that they should not lie in water. In some particularly wet sections the ground was opened, broken ducts were repaired, and the conduits waterproofed. All manhole lids were fitted with rubber flanges and bolted down to prevent the ingress of surface water.

Improvement by Boosters

In February, 1934, the Tramway Co. erected a booster at its "A" station connected to the negative return feeder from the western district, which is the most heavily loaded traffic area. The effect of the booster is to assist the return of current from the rails *via* the negative feeder cable, which it does to the extent of from 50 to 70 A. A further set of readings was taken (see broken line on the graph, dated 6/9.3.34), which showed a decided improvement in the curve. About 40 per cent. of the leakage current had been diverted to its proper path in the feeder cable for the western districts, while the positive cable area in the central danger zone was decreased both in length and intensity by about 20 per cent. The maximum potential difference in this area fell to one volt, and it is considered that this is a reasonably safe figure. The Electricity Regulations' maximum allowance is 1.5 V.

It is in this central area, also, that there are the greatest number of large telephone cables and, consequently, what electrolytic action there may be is spread over a bigger quantity of lead sheathing. Following up this point, if later or more cables are laid, it might be advisable to reduce the resistance in bond "A" and thus still further lower the potential differences. The Telephone Co.'s cable system is always growing, so that as time goes on there will be more and more lead sheathing over which the electrolytic action will be distributed and consequently there will be less corrosion on any one cable. This may be offset, however, by increasing traffic on the tramways, and the current load may possibly increase beyond the capacity of the negative feeder and its booster. In this case, the Tramway Co. must either increase the number of its supply stations or lay new negative return cables, care being taken that they are properly spaced to even out their loads.

The booster equipment made no changes in the eastern districts, so tests were made with a view to locating the cause of the high voltage between rail and cable at that end of the route. At point "G" is situated a large shipbuilding and engineering works, Taikoo Dockyard. In May, 1933, one of their main power cables burned out and an adjacent small telephone cable was damaged. This led to several tests being made. The power supply from outside is at 6,600 V, 50 cycles, a.c., with a rotary conversion to 200 V d.c. for use inside the works. The armoured telephone cable serving the dock passes down a vertical rock face in reasonably dry surroundings, and this point was chosen to break the continuity of the armouring and lead sheathing. It was found that a potential difference of 0.9 V existed, with current flowing from outside into the works. A vertical insulated joint was made with rubber tape and compound and was supported on insulators away from the rock face. New readings between the rails and cable showed a further improvement in that district (see chain-dotted line on graph, dated 9/11.7.34), and the cable was rendered more negative to the general earth.

Other Forms of Corrosion

There are other forms of corrosion which may be mistaken for electrolysis. One such case was observed in a manhole some 150 yd. from the sea, but at about sea level. At extra high tides this manhole filled with foul water, which receded to duct level as the tide ebbed. An 800-pair cable joint was lying in this water and was attacked only on those parts of the joint where plumbers' metal existed. The deposit in this case was yellowish brown and the corrosion of the tin from the solder was probably due to chemical action, as the foul water was eventually traced to a sewage pipe leak.

Cases have occurred in which lead-covered cables in ducts have been corroded by the acid action due to insects, notably white ants. This invariably occurs near a timber yard or firewood shop, and the presence of insects and their larvæ identifies the cause of corrosion. In such cases the holes in the lead sheathing are filled with a whitish-grey deposit, and there is usually a quantity of sticky greyish mud in the duct. After the cable has been withdrawn from the duct and repaired, the duct has been flushed and mopped through with kerosene oil before replacing the cable.

Another type of corrosion occurs on armoured cables and appears to be a chemical action of the acids set up by the rotting of the jute serving between the lead sheathing and the steel armouring tape. Such action usually makes a spiral line round the cable corresponding with the lay of the steel tape and the deposit formed is whitish-yellow. It is hoped that this defect may be overcome by laying up a prepared impregnated paper tape directly on to the lead sheathing during manufacture.

New Tramcar Motor Bogies

MODERN tramway cars are required to have a big carrying capacity, and, at the same time, be as light as possible when empty. With this in view the Brown, Boveri Co. has so designed a driving motor for a light four-axle tramcar that the housing of the motor forms the bogie as well, so as to allow of a considerable reduction in weight of the underframe of the car. This suggestion came from the Wagonfabrik Uerdingen (Niederrhein) Gesellschaft, and has been patented.

The driving motor, placed lengthwise, is lodged between the two driving axles and has three-point suspension. The housing is secured to the driving axles by four arms, of which two are rigid and two movable. The motor drives the axles through bevel gears. The pivot of the bogie is on the top of the motor housing and is cast solid with the latter. Containers bolted on each side of the housing take the cylindrical supporting springs, which carry the weight of the tramcar body.

One of the driving axles is rigid, while the other is designed for a displacement of plus or minus one degree in a plane vertical to the longitudinal axis of the bogie. This flexibility allows the driving wheels to conform to any inequalities of the track, and the bevel-gear drive of the movable axle is equipped with an adjustable bearing with barrel-shaped rollers. This bearing, along with the two fixed arms of the housing, supports the motor.

Each of the two motors is designed for a continuous rating of 30 kW at 1,000 r.p.m. at 550 V and is of the self-ventilated type, the air inlet and outlets being on the upper side of the housing. The latter is of cast steel and forms a rigid whole with the fixed supporting arms. The two movable arms are articulated on the housing in such a way that either of them can oscillate in a plane parallel to the plane of the driving wheels. To relieve the roller bearing in the centre of the driving-wheel set flat springs are mounted on the housing and supported by the movable arms, being compressed thereby.

The whole motor bogie weighs only three metric tons, including the rail brake, wheel boxes, brake rods, and track clearer. The net weight of the four-axle motor tramcar for which the motor bogie was built is about 10¼ tons; its length is 41 ft. 3 in., and carrying capacity sixty seated passengers. Besides completely automatic multi-control, with the object of damping the effect of the unsprung weight of the motor supported by the axles, built-up wheels are used which incorporate a rubber cushion arranged to permit a maximum radial compression of 10 mm. with brake drums of the automobile type secured to the axles.

Testing Short-time Fuses. By F. M. Denton, F.C.G.I.*

Correlating the various factors

AN alignment chart for finding the short-time fusing currents for copper wire, based on a formula due to Onderdonk, which appeared in an American technical publication recently, gives reliable results only for fusing times so short that the fusing takes place before any appreciable cooling can have occurred by conduction along the fuse wire to the terminal blocks. Experiment showed, as was to be expected, that although reliable and independent of the length of the fuse wire and of the size of the terminal blocks for fusing times of a fraction of a second, the data obtained from the chart are unreliable for periods of several seconds.

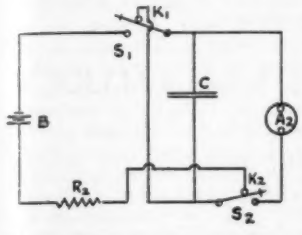


Fig. 1.—Timing system for measuring fusing interval

In checking the chart the fusing times were measured by means of a device consisting of a transformer supplying current to the fuse and a timing system (fig. 1). On closing the switch S_1, condenser C is charged through the high resistance R_2 by the battery B whose e.m.f. in volts is E. After the time interval which we wish to measure the switch S_2 is closed. This discharges the condenser through the ballistic galvanometer A, the throw of which is then a measure of the time interval between closing S_1 and closing S_2. R_2C is the "time constant" of the condenser circuit and equals the time taken for the condenser to receive about 63 per cent. of the final charge EC which the voltage E could put into it.

The quantity which enters the condenser during the time interval between the closing of S_1 and the closing of S_2, and which is later discharged in producing the throw of the galvanometer, is an exponential function of the time interval. The required exponential curve may be plotted easily. Such a curve is given in fig. 2 for the particular case in which the condenser C had a capacity of 4 mfd., R_2 was 30,000 ohms and the battery e.m.f. was 22½ V. The time interval R_2C was, in this case, $30{,}000 \times 4 \times 10^{-6}$ or 0.12 sec.

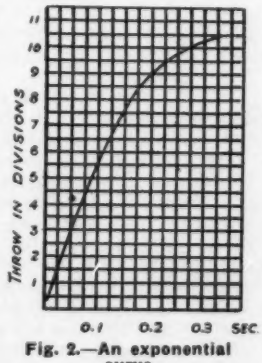


Fig. 2.—An exponential curve

Instead of a ballistic galvanometer it was found practicable to use an ordinary commercial d.c. milliammeter of a miniature round pattern with a 0.5 mA range. Its resistance was about 15 ohms and its time of swing about one second, the damping being such that it made about twelve to-and-fro swings before coming to rest at zero.

The curve of fig. 2 translates throws into seconds for the case in which R_2 is 30,000 ohms, the time range being about 0.2 sec. It was found possible, roughly, to multiply the time scale by any desired constant k by making R_2 equal to 30,000 k. For example, with R_2 equal to 30,000 a throw of 5.5 divisions meant a time interval of 0.1 sec., while with R_2 equal to 3,000 ohms the same deflection meant 0.01 sec. With R_2 equal to 300,000 it meant 1 sec. and with 3 megohms 10 sec.

Experiment showed that if an accuracy of 5 per cent. in the middle of the scale was sufficient, the same calibration curve could be used for a wide range of values of R_2. Considerable error occurs when R_2 approaches the same order of magnitude as the insulation resistance of the condenser itself.

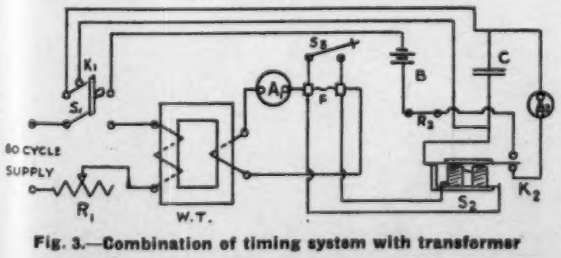


Fig. 3.—Combination of timing system with transformer

It is important to work on the lower part of the curve of charge, well below the knee. This condition is ensured by proper choice of the capacity C and the voltage. The time intervals used in plotting the curve of fig. 2 were measured by aid of a 60-cycle 1,800-r.p.m. synchronous motor, driving, through a fifty-to-one-worm gear, a turntable which actuated the keys K_1 and K_2. The combination of such a timing system with the transformer is shown in fig. 3.

The small welding transformer WT (rated at, say, 1½ kVA, 110/22 V 60 cycles) is controlled by one of the blades of the d.p., s.t. switch S_1 and supplies current to the fuse. The fuse can be short-circuited by a switch S_3 in order that the fusing current measured by the ammeter A_1 may be set beforehand at any desired value—adjustment being effected by the primary rheostat R_1.

The second blade of the switch S_1, to which an auxiliary contact K_1 is fitted, corresponds to the contact K_1 of fig. 2 (it serves to dissipate residual charge in C). The improvised switch S_2 of fig. 3 is a bell movement the clapper arm of which is drawn down to the contact K_2 as soon as the blowing of the fuse causes the voltage across the fuse terminals to rise.

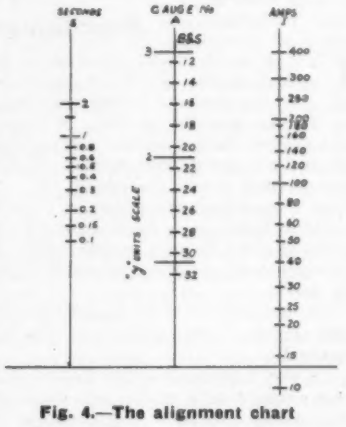


Fig. 4.—The alignment chart

In order to test a fuse the ammeter A is adjusted to the desired current (S_3 being closed meanwhile so as to short-circuit the fuse) by means of R_1. Then S_1 is held in the upper position so that K_1 is closed and the supply circuit is open. S_3 is now opened, and, in order to take a reading, S_1 is suddenly closed. The ammeter A_2 is carefully watched and its maximum throw (which occurs as soon as the fuse blows) is read. The meaning of the throw in seconds is obtained by reference to the curve of fig. 2, due allowance being made for the particular value being used for R_2.

The construction of an alignment chart or "nomograph" is based on simple principles, namely, first, the geometrical principle that if y_1 and y_2 are two vertical lines drawn upon a common horizontal base, then the length of a middle line bounded by the cross line joining the tops of y_1 and y_2 is equal

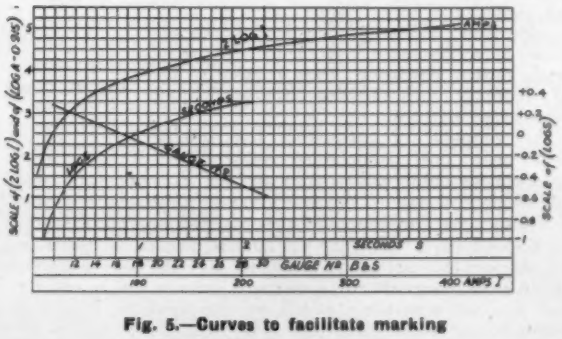


Fig. 5.—Curves to facilitate marking

to the average of y_1 and y_2, *i.e.*, $y_3=(y_1+y_2)/2$, and next the logarithmic principle that $\log ab=\log a+\log b$.

The divisions on the side lines are like those on an ordinary slide rule, *e.g.*, the number of inches from 1 to 3 is proportional to log 3 and the number of inches from 1 to 5 is proportional to log 5. The numbers placed on the middle line must be the squares of those at equal levels on the side lines. In order to multiply two numbers together, as, for instance, 2 and 3, we lay a straight-edge from point 2 on one side line to the point 3 on the other side line and find the product 6 on the middle line.

If we designate the numbers on the side lines a and b and their alignment number on the middle line c, the rule is $(a \times b)=c$. The formula $I^2S=(1.49/100)\ A^2$, where I is the fusing current in amperes for a time S seconds for a wire having a cross-section of A circular mils, becomes in the

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logarithmic form, (2 log I+log S)/2=(log A−0.915). It happens that the B and S wire gauge is approximately logarithmic, hence we find the centre scale equally divided for the gauge numbers. For instance, B and S No. 8 has A=16,510 circular mils and log A is 4.218; No. 10 has A=10,380 and log A is 4.016; No. 12 has A 6,530 and log A is 3,815. The difference between 4.218 and 4.016 is about he same as between 4.016 and 3.815.

Along the three verticals S, A and I of fig. 4 are marked, respectively, the fusing times in seconds, the gauge numbers and the fusing current in amperes. Three curves have been plotted (fig. 5) to facilitate the marking, namely, the S curve, y=log S; the gauge or A curve, y=(log A−0.915); and the current for I curve, y=2 log I. The values of y may be expressed in any convenient units of length.

In order to locate any point on the chart, as, for example, 18 on the gauge line, we refer to the gauge curve of fig. 5 and find that the point 18 on the x axis corresponds to 2.3 on the y axis of that curve. This means that 18 on the chart is 2.3 length units (y units of fig. 4) above the origin 0.

The point 0.2 sec. on the S line of fig. 4 is found thus: The 0.2 sec. point on the x axis of the "seconds" curve of fig. 5 has the ordinate y=minus 0.7 along the y axis of that curve. This means that the point 0.2 on the S line of the chart should be minus 0.7 units of length (y units) below the x axis of fig. 4. For compactness, however, we have added the arbitrary length 2.2 to all the ordinates of the S curve, bringing the point minus 0.7 to plus 1.5. In compensation for this raising of the S points we have lowered the I quantities by an equal amount so that, for instance, the ordinate y=4.9, of 300 A on the current curve has been plotted at (4.9−2.2) or 2.7y units of length above the axis of fig. 4.

Temperature Curves. By D. G. Sandeman, B.Sc., A.M.I.E.E.

Ascertaining the final figures from a simple formula

CALCULATIONS of temperature rise are vital in all electrical work. In cooker design, heater calculations, and all machine and transformer design, temperature rise is at the centre of the problem. I believe that a description of the method here used has not yet appeared in print; it enables the design to be completed should only a fragment of the temperature curve be available.

If a thermometer is placed in a cooling body, and the readings are noted every ten minutes, the results when plotted on squared paper lie on a smooth curve. The shape of this curve is reproduced exactly, but inverted, of course, when a body is heated.

The temperature of the heated body rises rapidly at first, then less rapidly, and approaches the final temperature very gradually.

In the mathematical treatment one incorrect assumption is made, i.e., at any instant the cooling is directly proportional to the temperature rise. In other words, the problem is regarded as one of conduction only, radiation being neglected, and this affects the results obtained in practice.

The energy equation at any instant is: Total heat=heat lost+heat absorbed. The solution of this equation is in the form, $\theta=\theta_y(1-\varepsilon^{-\frac{T}{X}})$, when θ=temperature rise, θ_y=final temperature rise, ε=2.718, T=time from start of experiment, and X is the "time constant" in hours.

Finding the Time Constant

This constant X is proportional to the body's capacity for heat, or specific heat, and to its mass, and inversely proportional to a figure representing the efficiency of cooling. It is high for inefficiently cooled large bodies of great specific heat. For a medium-sized totally enclosed induction motor X is 1.15 hr. The same frame, when ventilated, gives a value of 0.6 hr. In small, well-ventilated machines X may be as small as 0.3 hr.

The formula for calculating X is specific heat × mass × final temperature ÷ watts × 60². If the specific heat is measured in joules per lb. per deg. F., mass in lb., and temperature in deg. F. the result will be in hours.

A simpler way of finding X is to plot the readings carefully on squared paper, drawing the tangent line to the curve at the start of the experiment. This tangent line represents the rate that the temperature would rise if unhampered by cooling, and X is the time taken at this rate to reach the final temperature.

Yet another way of stating X is to say that it is the time taken to reach 63 per cent. of the final temperature rise, but this figure is more mathematical than accurate. In the curve given for the totally enclosed motor this percentage of the final temperature gives only 0.6 hr. This departure from the mathematical curve is due to the importance of radiation in this instance. The other curve shows results obtained from a 25 h.p. 750 r.p.m. ventilated motor. The time constant from the tangent line and from the 63 per cent. reading are in close agreement at 0.35 hr. each, radiation here being responsible for only a very small percentage of the total cooling.

Commercially, it is desirable to reduce the duration of the test to as short a period as possible. Sometimes after plotting the readings of a commercial test the final temperature remains uncertain. In the example given of the totally enclosed motor a 4½-hr. test does not appear to give finality.

With a mathematical curve the final temperature can be easily determined from two readings at "a" hours and "2a" hours, that is to say, two readings at equal time intervals.

$$\theta_y=\frac{\theta_1}{2-\frac{\theta_2}{\theta_1}}$$

when θ_y=final temperature, θ_1=temperature at "a" hours, and θ_2=temperature at "2a" hours.

The totally enclosed 20-h.p. motor was run at its rated load for 4½ hours, this being the longest time available for testing at a busy period. Comparing the temperatures at two hours and four hours, a ratio of 1.135 is obtained, giving a final temperature of

$$\theta_y=\frac{80}{2-1.135}=94 \text{ deg. F.}$$

The next case to be considered is to determine the loading

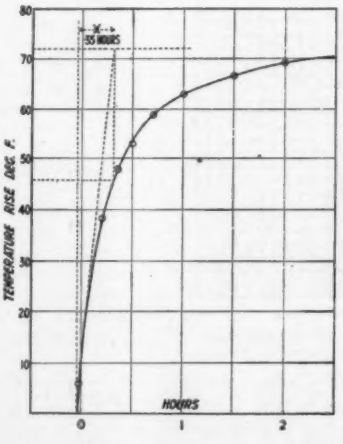


Fig. 1.—Curve for a 25-h.p., 720-r.p.m. ventilated motor.

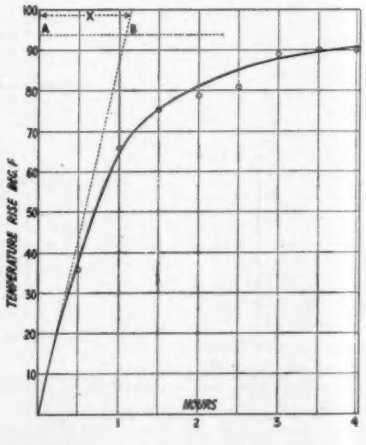


Fig. 2.—20-h.p. totally enclosed motor curve

to produce a given temperature rise after a specified time $\theta_2=\theta_{y_2}(1-\varepsilon^{-\frac{T}{X}})$ where θ_{y_2} is a new final temperature which equals $\theta_y\frac{W_2}{W_1}$

$$\theta_2=\frac{\theta_{y_1}W_2}{W_1}(1-\varepsilon^{-\frac{T_2}{X}})$$

$$W_2=\frac{\theta_2 W_1}{\theta_{y_1}(1-\varepsilon^{-\frac{T_2}{X}})}$$

For example, should it be desired to run the above 20-h.p. motor to give 90 deg. F. rise after one half-hour

$$W_2=W_1\frac{90}{94(1-\varepsilon^{-\frac{.5}{1.1}})}=W_1\,2.6$$

An increase of 160 per cent. in loss is allowable or approximately 60 per cent. increase in output.

A Comparison

The value of X obtained from the curve (the line AB) is 1.1 hours. To calculate this value it is necessary to know the design particulars which were: copper weight=150 lb., active iron weight=440 lb., total loss=1,600 W.

The specific heat of copper in joules (watt seconds) per lb. per deg. F. is 100, and of iron 126.5.

X=Σ(specific heat × weight) final temperature ÷ Watts loss = (150×100+440×126.5) 94÷1,600 seconds=1.15 hr. This is in fairly close agreement with the graphical result.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

New Zealand's Bold Electrical Policy

THE paper descriptive of the organisation of electricity supply in New Zealand which was summarised last week, was discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London, on Dec. 20th.

Mr. W. P. Gauvain presented the paper on behalf of the author, Mr. F. T. M. Kissel, who is chief electrical engineer of the Public Works Department, N.Z., and the first five and the seventh speakers in the discussion recalled impressions of their visits to New Zealand. The attendance was smaller than usual.

The president, Prof. W. M. Thornton, thought that the paper showed how supply could create demand. The coal used was all imported, but only about a tenth of the potential water power had been used so far. New Zealand might become one of the great manufacturing countries of the world; at any rate, she could make all she needed. To become productive, the central parts of the north island only needed fertilising. Abundant hydro-electric power and carbon obtainable from forest timber would enable artificial fertilisers to be manufactured in bulk. Would it be cheaper to manufacture locally, or to import such requisites?

Mr. W. P. Gauvain, in his own contribution to the discussion, said the paper showed what could be done in a large country with a small population. Large numbers of cookers, water-heaters, and milking machines were employed, while 110-kV transmission lines were in use before high voltage was adopted in England. British manufacturers were thus given opportunities of acquiring experience in the design of high-voltage equipment before it was needed in this country. Cost had been increased somewhat by civil and other engineering difficulties encountered as a result of the nature of the terrain.

Practically everything the Power Boards used had to be imported, except cement, and operations were started when the cost of materials and loans was high. Selling energy in bulk per kVA of maximum demand, without a unit charge, had resulted in extraordinarily high load factors being realised.

Lessons for the Mother Country

Mr. W. A. Coates considered that New Zealand's example was worth careful study. The work done there had provided British manufacturers with valuable experience. What was the explanation of the small fee paid to the chairmen of the Power Boards for the onerous duties undertaken by them? The provision for rating was one of the most interesting features of the scheme. Areas with much smaller populations than the 70 to 100 per sq. mile considered necessary in this country had been profitably developed, which showed how the adventurous spirit could be justified. Wayleaves were almost unknown and the Post Office did not have any prior rights. Some high-voltage lines had been erected at surprisingly low prices. In spite of the cost of civil engineering works, the expenditure per kW installed was not excessive, while the cost per kWh was lower than in this country. It would pay to investigate New Zealand's methods, from which this country could learn much.

Mr. E. E. Sharp hoped that this paper would be the first of many from overseas. He admired the way in which public works were carried out in the Dominions; it required courage to spend so much money when the population was so small. In many rural districts the maximum demand was imposed by the milking machine load. Although 36,000 electric cookers had been installed, he understood that 154,000 gas cookers were still in use, which indicated that much remained to be done. New Zealand engineers did not seem to do much to induce domestic users to install more current-consuming apparatus. Most domestic users were willing to buy their equipment, but he did not agree that that was sufficient reason for not introducing hiring schemes. Bulk supply tariff revision was being talked about.

Ten Years Ahead

Mr. V. Z. de Ferranti said that after seeing what had been done in New Zealand he was disgusted at the way rural districts were catered for at home; they were ten years ahead of us in tackling all areas outside towns. The first 110-kV transformers to be made in England were supplied for the Mangahao plant; the placing of that order in England was a great act of faith and he was glad the purchasers had not been let down.

Mr. A. N. D. Kerr said that the "availability rate" caused him some apprehension, especially as it represented 10 per cent. of the whole rate collected. That was hardly a method for adoption in this country. If the Power Boards collected rates, what were they in turn liable to pay in rates to local authorities? The method of charging for bulk supply (without a unit charge) though good, was not applicable in this country. In effect, the charge was made for providing the service, like water. The Power Boards had realised that they were responsible not only for providing the supply, but also for the way in which it was used.

Mr. W. Wilson remarked that the methods adopted were those which suited the characteristics of the people who used them. When comparisons were being made the different conditions obtaining in the two countries must be remembered. In Great Britain the supply system was centralised under the C.E.B., whereas in New Zealand it was decentralised and the Power Boards never interfered until asked to do so. Their success had been due to co-operation. The Boards were much like our local councils; they purchased power at a certain price and then set about selling it at the most advantageous kWh rates. Great Britain did not need lower prices so much as higher load factors. The standard of wiring in New Zealand in 1915, before the registration of contractors, was considerably higher than it was in this country.

Mr. H. Bentham asked for information about the degree of reliability of supply. How many interruptions occurred and what caused them? When obtaining wayleaves in this country 12 to 18 months were needed in which to settle details before work could be commenced. The grid tariff was considered to be high, but at 25 per cent. load factor the New Zealand land tariff was slightly higher per kWh.

Mr. W. McClelland asked why a guaranteed return of 17 per cent. was needed before a loan could be sanctioned for extending lines to outer districts when elsewhere they had done so well with 10 per cent.

Mr. W. P. Gauvain, in reply, explained that a 17 per cent. return was required to prevent bad extensions. The same bulk rate was charged whether the purchaser was 10 or 100 miles away, and so far as he was aware no change was con-

Three views of the Connaught Rooms showing the beauty and effectiveness of the new lighting. From left to right: The main vestibule; the Grand Hall, with direct and indirect illumination; and the Cambrian Room. **(See p. 892)**

templated in the system of charging. He agreed with the New Zealanders that if they could do without hire schemes so much the better. Such schemes necessitated the supply authorities finding more money, and so long as consumers were prepared to purchase, or hire-purchase, their equipment why suggest that they should do otherwise?

Peaks were avoided by not allowing water heaters to be used at the same time as milking machines. Several schemes had been suggested for manufacturing artificial fertilisers with the aid of cheap water power, but he thought the Government was wise in retaining control of the electricity supply; eventually something would probably be done under Government licence. The reliability of supply had been good and much of the success achieved had been due to the keenness and co-operation of the farmers. They realised that the availability of power increased the value of their farms, and also (because labour was costly) that its use enabled one man and a boy to run a farm.

Earth Leakage Trips

MR. T. C. GILBERT'S paper on "Earthing for Protection," reported in our last issue, was read at a meeting of the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS on December 18th.

The president of the Association, Mr. J. M. Kennedy, in opening the discussion, said that the Dumfries County Council had tried several methods of earthing, but the only sufficient protection was by the installation of earth leakage trips. The speaker thought that the lecturer had done the English manufacturers an injustice when he referred to the high prices of English made devices, since these were now available at reasonable cost. He asked how a simple earth spike, possessing any resistance up to 500 ohms, could be driven alongside the apparatus to be protected, when the latter was situated inside a house. For small installations, a single pole device was all that was necessary at the present time.

Mr. Rissik referred to Mr. Gilbert's statement that in rural areas resistances of 100 ohms were met with, and mentioned that I.E.E. Regulation 1005 laid it down that an earth leakage trip must be installed which would operate at 30 mA. If the current value was already specified it was impossible to lay down the voltage rise, since the current and the resistance would settle this.

Another speaker said that Mr. Gilbert had mentioned 100 ohms for the earth resistance, but in some rural areas with silver sand, a resistance up to 5,000 or 6,000 ohms was experienced. He also mentioned that he noticed the trip device which Mr. Gilbert had demonstrated had the red button wired on the incoming instead of the outgoing side. The lowest quotation he could get from a British firm for house-service trips was 21s. 6d., and if five of these trips were installed the cost would be prohibitive. Would it be detrimental to put in one trip of sufficient capacity for the whole of the apparatus installed?

Trips in Parallel

Mr. G. Jelley asked how it was possible to put six of these trips in without putting them in parallel. Another member said it might not be possible to obtain an earth leakage trip of sufficient capacity to take the full load of an installation, and asked, where two trips were working in parallel, whether there was any likelihood of a fault on one circuit tripping both switches.

Mr. W. Lang said he thought that the first cost was of no consequence at the moment; the principle had first to be established, and when it was adopted, these trips would be made by mass production and their cost would become reasonable. There were other difficulties beside the current and voltage, such as the time element. He quoted an instance where a shock of 230 V lasting two seconds had not been fatal, but if the time element was assumed to be practically instantaneous, and the current value put at 30 mA, one would then only be closely within the limits of safety.

The question was asked why metallic casings should not be used for leakage trips and whether one was correct in assuming that the operating gear should not come into contact with a direct earth, otherwise it would be cut out. Mr. Brown endorsed Mr. Gilbert's remarks concerning the high prices of British made earthing trips. He had made inquiries in several quarters regarding a leakage indicator, which would make a complete record of faults to earth, but had found that there was not such a device on the market. He thought that such an indicator could with advantage be fixed to the ordinary service meter. Mr. Jelley replied that in nine cases out of ten in a three-phase four-wire supply the neutral was earthed. In this case, there was a current passing from phase to earth the whole time. What sort of a record would that indicator keep of a fault that was passing in parallel to earth at the same time?

It was also said that the British manufacturer had only just started doing what the German manufacturer had been doing for a number of years. Six months ago the price of this apparatus was a little high, but apparatus was now available at a reasonable figure. By installing leakage trips, the main switch and fuses would be dispensed with.

The Author's Reply

Replying to the discussion Mr. Gilbert said that he was bound to state that the British apparatus he had tested did not compare favourably with the Continental; British devices had an extreme lightness of action, which caused the switch to trip under vibration, and there were losses with the coils connected across the mains. In rural districts many cookers stood on a brick floor and one could easily put the earth spike through the joints of that floor or just outside the wall. By the use of a test key the meter reader was able to ascertain whether the earth connections were intact. Separate protection for each appliance was necessary if they were to be of any use, and, in any case, why cut out every circuit in the installation because of a fault on one? Where a number of trips were used, it was necessary to place them in parallel. It was possible that a fault might trip both switches if two were placed in parallel, or the wrong switch might trip out.

Mr. Booth, chairman of the Association, proposed a vote of thanks to the speaker and Mr. Fawdry seconded.

Some Physical Papers

AMONG the papers presented at the PHYSICAL SOCIETY on December 21st was one by Mr. G. Millington on "Ionisation Charts of the Upper Atmosphere: Part II," which discusses an envelope correction to some ionisation charts previously published, and in addition presents the new charts on a circular projection to help in the study of conditions in the polar regions.

A paper on "Some Experiments on Electronic Oscillations," by Dr. W. A. Leyshon, gives results of measurements made on the wave-length of the oscillations generated by small triodes using the positive-grid (Parkhausen-Kurz) method, in a fixed oscillatory circuit which, in most of the cases studied, was formed by the valve electrodes and leads. It was found possible, with the grid current emission limited, to express the relation between the generated wave-length, the grid voltage, and the plate voltage by a straight-line graph. It is suggested that triodes connected in the manner described might be used as oscillation wave-meters working over a limited range.

Intermolecular Action

In a paper on "Models of the Superposition and Interpenetration of Components in Gas Mixtures adsorbed upon Thermionic, Photoelectric and Catalytic Surfaces: Part I, Principles," by Dr. M. C. Johnson, models of intermolecular attraction and repulsion are developed to represent the penetration of one adsorbed substance through another. Such interchanges between two or more components are important in view of the complex surface structures required for control of thermionic or photoelectric emission, and for the many physical and chemical experiments in which a metal is covered with a thin deposit of another metal over an intermediate gas layer: the latter may reach its final equilibrium between the metals after migration from above or below.

* * *

Modern Fuse Protection

At the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS held in London on December 17th Mr. J. F. Shipley opened a discussion upon "Modern Fuse Protection, 400 V to 122,000 V," by tracing the development of fuses from their simple beginnings and describing their types and composition. There were two fundamental principles in the construction of fuses. The first involved the choice of a metal from silver, tin or lead, with the consideration of low or high temperature of melting and of oxidisation; the second was the method of construction, which should provide for (1) noiseless operation, (2) arc extinguishing, and (3) elimination of smoke or vapour. It was desirable that fuses should be repairable, but the restoring of fuses should not be the duty of slack or irresponsible workmen. Mr. Shipley believed that a very large proportion of fuse rupturings was due to temporary disturbances, and not to "dead shorts," and an easily replaced fuse was therefore a highly satisfactory way of meeting the emergency. Mr. H. Simmonds said a fuse was not suitable for very fine overload protection; this must be the duty of a circuit breaker. He described the modern design of fuses of high rupturing capacity for low and medium tensions, and showed numerous slides and oscillograph records to illustrate their performance upon rupturing. The fuses he favoured included a prepared link that rapidly volatilised and by the special nature of its vapour actually behaved as a current-limiter and gradually supressed the surge.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

A.c. Lift Controllers

In reply to Mr. Macmillan's criticism (in your issue of December 19th) of my article on this subject, I repeat that the lift controller is continually operating; one lift manufacturer states that in an installation under supervision an average of 3,000 journeys per week was noted. This heavy service demand causes wear on armature spindles and bearings, and since in lift control gear these are usually of small dimensions the net effect is to give considerable play to the armatures. If a.c. contactor coils are used the result is chattering, vibration and noisy armatures.

Mr. Macmillan did not make clear his criticism of my statement that the a.c. contactor coil may be damaged by excess current if the armature does not go right home. It is true that the d.c. control circuit may have a little more vicious arc to break, and that the induced voltage may be greater. The latter is easily provided against by extra insulation.

I agree that a bronzed, even contact surface should not be interfered with. In my experience "pitting" and "blobbing" occur simultaneously. Since, by reducing contact area, these cause increased heating, arcing, and rapid deterioration of the contact, they should be given prompt attention.

In conclusion I would say that I know at least nine manufacturers that have adopted the d.c. control circuit. Surely these firms do not add "gadgets" to their gear, making it more complicated and expensive, unless experience has shown it to be an improvement.

Dundee, *December 17th.* W. WOODIWISS.

A Suggestion for Cooker Manufacturers

Although there are some excellent cookery books distributed by cooker manufacturing firms for issue to users, the perusal and study of them is apt to prove a lengthy and tiresome job to the housewife with little time and inclination for such things. I would suggest, therefore, that a useful purpose would be served if a handy pamphlet or leaflet were printed and issued—in addition to a cookery book—to all users, the leaflet to take the form of "Don'ts for Cooker Users." A very helpful leaflet could very readily be compiled from the accumulated experience of manufacturers' demonstrators and others.

A few "don'ts" occur to me as I write this and could find a place in the suggested leaflet, *e.g.*:—"Don't fill your saucepan full of water when boiling vegetables. Half full is sufficient, the steam does the rest. It wastes time and money to boil unnecessary quantities of water." "Don't place the tin tray on the top shelf of the oven when baking potatoes. They should be put on the bottom shelf."

The list could be added to considerably, but the above is an example of what use could be made of the suggestion if manufacturers and others decided to adopt it. Such an idea may be in use already but I have not yet come across it.

Reading, *December 11th.* A. V. CROSS.

Fractional Horse-power Motors

Whilst agreeing with the majority of Mr. S. F. Philpott's views on fractional horse-power motors, expressed in his article in the ELECTRICAL REVIEW of December 14th, I feel that he does not do justice to moulded commutators. Although he qualifies his remarks by stating that trouble is becoming less general, he leaves the impression that the moulded type of commutator is inherently inferior to the other types.

It is true that much trouble has been, and still is, experienced when such commutators are made by firms lacking the considerable experience necessary, but it is only fair to point out that moulded commutators are available which, in my opinion, are definitely superior. I cannot call to mind a single case of "tracking," the fault specifically mentioned, during a period of about two and a half years, which covers many thousands of these commutators up to about 2 in. diameter. I think I am correct in stating that this is the only type of commutator available commercially which will permit a flash test at 2,000 V on a motor of such small size.

It is not only in its insulating properties that a moulded commutator is superior, for it has been proved that such commutators can be built to withstand the centrifugal forces due to enormously high speeds. I have knowledge of such commutators up to 1¼ in. diameter in production in large quantities weekly, all of which are suitable for running at over 10,000 r.p.m., and many of which in service reach speeds approximating 20,000 r.p.m. These commutators satisfactorily stand a speed test of 25,000 r.p.m. A recent comparative test of one of these commutators against one of the pressed-up type showed far greater distortion in the case of the latter at speeds approaching destruction.

To obtain these results it is, of course, essential that the moulding material should be used only for bonding, and the design should incorporate some means of preventing tensional strains upon it. I do not suggest that such performance could be obtained from any moulded commutator, as the design in question incorporates the outcome of very considerable research.

Turning to brush-gear, Mr. Philpott gives the impression that motors up to ¼ h.p. with adjustable brush rockers are unusual, but there is on the market a range of motors incorporating this feature in all sizes from about 1/40th h.p. upwards, and these are being sold in large quantities. The ease of obtaining uniform performance and at the same time securing good commutation make the feature well worth while, and its incorporation has not increased the price. H. G. POXON.

Pinner, *December 17th.*

Mr. Philpott raises rather a controversial point when he states that in using leatheroid (or presspahn) and empire cloth in slot insulation the latter is put next to the iron. Whilst I agree that these two materials are good for their purpose, I consider that the order should be reversed.

The insulation value of empire cloth is well known to designers; a piece of the thickness mentioned by Mr. Philpott will stand a flash test between *smooth surfaces* of 1,500 V r.m.s., but should these surfaces be rough the cloth will break down very quickly. To maintain its high insulation value this cloth must depend upon adequate mechanical protection; so, surely, if the windings are a primary consideration in insulation, the leatheroid is the mechanical protector against the chafing which takes place through the many stresses present in the core. This applies particularly to the armature.

Where the leatheroid is on the outside the slot can be finished off in a much more efficient manner, as it provides a better protection in the apex of the slot and is not liable to damage when a retaining wedge is driven in.

London, W.C.1, *December 17th.* ROY H. HEPBURN.

Two-part Prepayment Meters

"Avec" does scant justice to the research departments of many meter firms in dismissing their "variable standing-charge compounds" in six lines in his article in your issue of December 14th. A number of firms offer these, and if he is aware of this, why did he condemn the type of meter which uses them by making irrelevant statements regarding the large number of "compounds" to be carried in stock, and the necessity for taking off the meter cover, which he points out is an undesirable feature? With this type of meter, taking off the cover is quite unnecessary, and it can be graded accurately in halfpenny steps from nothing up to as much as it is possible to collect as a weekly charge.

An objection to the Ferraris motor, apart from the ones which Mr. Philpott enumerates, is that with "only a stop-watch and suitable tool" an accuracy of 1 per cent. plus or minus is as good as can be expected from testing on site. This may seem good until it is applied to a time constant. "Avec" would not think much of a clock on his desk that lost or gained a quarter of an hour each day! This error, which is really quite unavoidable, will mount up to nearly two hours in a week, and is entirely eliminated by the meter with a synchronous motor, tied to the controlled frequency.

Cardiff, *December 17th.* WILLIAM ROBERTS.

The E.D.A. Films

I have read with interest the letter signed "Food for Thought" and Mr. Roles's reply thereto, and I think he has dealt with the matter excellently. Destructive criticism is of no help to anyone, but I feel sure that E.D.A. would welcome constructive criticism on its new venture.

I attended the pre-view at Lincoln which was held in a small hall such as will probably be used for the majority of the shows to the general public throughout the country, and I think that those who have attended pre-views under these conditions, as distinct from those who have seen the films in comfortable theatres, will realise what must be done to send an audience home fully satisfied.

It must be remembered that it is most difficult to produce propaganda films that will hold an audience even under the most comfortable theatre conditions, and it is hopeless trying to compare the E.D.A. productions with modern super-films.

It therefore behoves those who are booking these films to assist the distributors by making the audience as comfortable as possible, bearing in mind that many a good show has fallen flat through hard seats, whereas many an indifferent show may be well received under conditions of comfort, such as one gets in an up-to-date cinema or theatre.

Having referred to constructive criticism I should like to offer a little. So far as possible halls should be chosen that are not draughty and can be satisfactorily warmed. The acoustics of many church and village halls are, of course, poor, this being the case at Lincoln, but this can to some extent be corrected by hanging up butter muslin baffles on the steel tie-bars that are usually found in halls of this type. At Lincoln the projectors seemed to be extremely noisy even to those sitting furthest away from them, and I suggest that the distributors might provide a simple collapsible screen to cut down this rather objectionable noise.

The programme runs rather short, and I believe takes just over 1½ hours to run through. This may be long enough if the showing conditions are not ideal, but it is asking rather a lot to fetch people out from their fireside on a cold winter night for such a short show. I therefore think that an interest and a comedy film might well be introduced between the first and second, and the second and third E.D.A. films in order to bring the programme time up to nearly two hours. I understand that the distributors usually have these films in stock, and could add them to the programmes if desired for a very small extra cost.

The second film, "Well I Never," has rather too much dialogue by an unseen commentator, and hardly any by the actors. This seems rather bad in a film of such length, and whilst the idea is sound, it has been carried rather too far, and I think should be avoided in any future productions.

Although I am afraid the films will not be quite so well received in large cities and towns where super-cinemas exist, they should prove most valuable propaganda in the smaller provincial towns and villages where the public have not become satiated with "talkie" programmes of very high standard, shown under luxurious conditions in palatial premises. I feel that the staffs of undertakings must work closely with the distributors appointed by E.D.A. in order to show these films under the best possible conditions in the many really unsuitable halls that must of necessity be used.

H. PAYN, *Engineer and Manager*,
Boston & District Electric Supply Co., Ltd.
Boston, Lincs, *December 17th*.

The Supply of Electricity

The fourteenth annual report of the Electricity Commissioners

THE year ended March 31st, 1934, covered by the fourteenth annual report of the Electricity Commissioners (Stationery Office, 3s.), which was published this week, witnessed the first sustained improvement in industrial conditions in Great Britain since 1930.

The total kWh generated by authorised undertakings was 14,175 million—an increase of 13.3 per cent. on the previous year, three-quarters of which took place during the last six months; the advance was the largest in any year since the first issue of the Commissioner's statistics in 1920-21. In the depressed areas of Central Scotland and N.E. England the output is nearly up to the 1929-30 level and in the others has improved over it by from 22 to 100 per cent.

Of 631 authorised distributors, 516 had assisted wiring schemes, 435 hired out apparatus and 480 offered it on hire-purchase terms. The number with all-in or two-part tariffs was 527.

An analysis of the fuel consumption returns for 1933 has been issued as a separate document (ELECTRICAL REVIEW, July 13th, 1934). The number of power stations dealt with was 489, including forty traction and non-statutory undertakings. This figure is thirty-two less than in the previous twelve months owing to the closing of forty-three stations, the exclusion of Guernsey, the starting up of eight new stations and one stand-by station, and the inclusion of three existing stations previously non-statutory. Of the 449 stations owned by authorised undertakings, 237 belonged to public bodies and 212 to companies. Sales of electricity by authorised undertakings in 1933 were 10 per cent. over the figures for 1932, giving an average consumption of 245 kWh per head of the present population.

Rural Demonstration Schemes

Twelve pages are devoted to the Bedford and Norwich demonstration schemes. In the Bedford rural area 67 per cent. of the occupied dwellings have been connected up (including over 200 farms) and the sales in 1933-34 were up by 43 per cent. on the previous year. The energy sold for domestic purposes and shops averaged 560 kWh per consumer. Over half of the total sales of 5,200,000 kWh were to twelve power consumers, chiefly for brickworks, at an average rate of 0.52d. per kWh. The rate for the 3,873 domestic and commercial premises averaged 1.64d. per kWh; the installations included 1,239 cookers, 104 washboilers, and seventy-two water-storage heaters. There was a deficit of £5,591 on the total capital expenditure of £217,000, partly due to the coming into force of a lower secondary charge of the two-part tariff.

Under the Norwich demonstration scheme, more than three-quarters of the 1,540 residential consumers occupied premises with an annual rateable value of less than £10. There are over 150 farms connected and five power consumers; the latter took only a small proportion of the total energy supplied. The increase in kWh sold was nearly 64 per cent. Sales per domestic consumer now represent 362 kWh per head. Of the total load of 3,576 kW, 642 kWh was for lighting, 2,648 kW for heating and cooking, and 286 kW for power. Above 70 per cent. of the consumers have installations under the assisted wiring plan. The net deficit was £3,453, but like the Bedford scheme this is a case of forced growth.

Loans authorised, apart from £5,125,000 required for the C.E.B., amounted to £12,850,000 of which about two-thirds was required for mains and services, a proportion in excess of the average for the preceding years. The aggregate of the loans sanctioned since 1919 is £239 million. The Commissioners secured restitution to the reserve fund of an electricity undertaking of an illegal appropriation in relief of the local rates. They also intervened in one case in which a local authority had decided to supply electricity without charge for public lighting with the same purpose in view. It is stated that sanctions will not be given to the borrowing of amounts in excess of the lowest satisfactory tender, because of such extraneous reasons as the desire to provide employment locally.

Bulk supplies were given by 160 authorised undertakings and received by 430. In addition fifty-six authorities took bulk supplies from private sources, but the amount was less than 2 per cent. of the gross public supply.

Sanction was given for the installation of 114,096 kW of generating plant, compared with 66,774, kW in the previous year. The new stations had a rated capacity of 210 kW only. The principal consents related to the 100,000 kW turbo-alternator at Battersea (London Power Co.), and a 6,000 kW water-turbine set at Maentwrog (North Wales Power Co.).

Among the nineteen consents issued (apart from those to the Central Electricity Board) for main transmission lines, three related to 66-kV overhead construction for the S. W. & S. Power Co. and the S. Wales Power Co. and underground for the London Power Co.

Approvals were given to twenty-five undertakings relating to alterations in frequency or voltage. The payment of subscriptions by 28 undertakings to the following associations was approved:—Electrical Research Association, E.D.A., the B.S.I., the E.A.W., and the I.M.E.A.

The report contains particulars of each of the seventeen cases determined by the Commissioners and awards by referees in respect of compensation owing to loss of employment due to bulk supply arrangements. Apart from the general supply Bills introduced during the year under review and the Local Government Act (brief accounts of which are given), there were twenty-three local Acts containing provisions bearing on the supply of electricity.

Apportionment of Expenses

The net administration expenses of the Commission amounted to £49,955; equivalent to 1.225d. per 1,000 kWh sold to consumers. The staff consisted of seventy-nine persons, of whom fifty-eight were established officers.

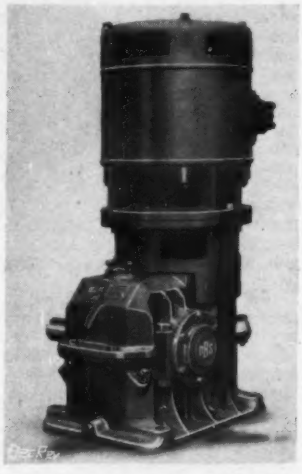
The interest and sinking fund charges on expenditure incurred in frequency standardisation by the Central Electricity Board are reimbursed by the Electricity Commissioners, who apportion the amounts payable among authorised undertakings in proportion to the revenue received from the sale of electricity, excluding bulk supplies to other undertakings. The payments in 1933-34 worked out at 16s. 4d. per £100 of gross revenue.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Geared Driving Units

The success attained by the horizontal-motor "Radicon" self-contained geared motor driving units introduced by MESSRS. DAVID BROWN & SONS (HUDD.), LTD., Huddersfield, has led to the introduction of the vertical-motor unit operating on the same principle. The outstanding feature of the "R.M.V.H." single-reduction "Radicon" reducer is its compactness. Not only is the mechanical portion of the smallest possible dimensions, but the motor is so positioned that the equipment occupies the minimum floor space, and the bedplate, which is usually necessary to preserve alignment between the motor and the gear, can be dispensed with. The motor is flange-mounted to an extension of the worm gear housing which also forms a cowl for the "Radicon" fan. A flexible coupling is interposed between the motor and gear, and the motor can be removed bodily without disturbing the alignment of any bearing.



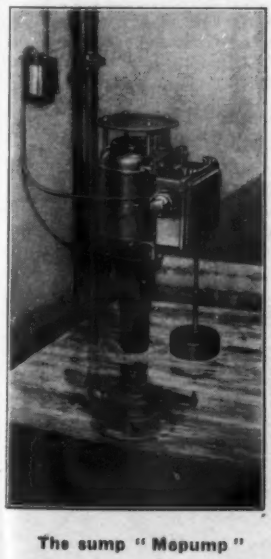
An "R.M.V.H. Radicon" reducer

A stand-by motor can be quickly substituted merely by interchanging the driving end brackets, while dismantling of the gearing can be carried out conveniently, the case being split horizontally through the axis of the wheel shaft. Speed reductions up to 60 to 1 are obtainable by the worm gears, so that output shaft speeds down to 12 r.p.m. or less are available, according to the motor selected.

The worm and wheel shafts are carried on ball or roller bearings, while radial and thrust loads are taken by radial ball bearings. An additional roller bearing is provided in cases where heavy overhung loads have to be carried by the wheel shaft.

Self-contained Pumping Units

At the Waterloo Engineering Works, Gorsey Mount Street, Stockport, of MESSRS. RHODES, BRYDON & YOUATT, LTD., which we recently visited, self-contained pumping units are made for practically every purpose. The sump "Mopump" is an interesting example. It is complete with automatic starting and stopping gear and is suitable for draining cellars and for supplying coolant liquor to machine tools. Although arranged for vertical-spindle operation it is of standard "Mopump" construction, except that the switchgear is of special design. A d.p. heavy-current mercury-contact switch is provided, and the two mercury units are carried in a suitable tilting cradle which is operated by the rise and fall of a float through a springless mechanical gear, ensuring positive action. Removal of the two-pin plug completely isolates the equipment.



The sump "Mopump"

A milk or wine equipment is of similar construction, except that the pump proper is easily and wholly removable for sterilisation by unscrewing wing nuts. There is a special open impeller, and the whole of the interior and exterior of the pump are sand blasted and polished to a fine finish.

Low-pressure Relief Valve

A combined isolating and relief valve has been developed by MESSRS. HOPKINSONS, LTD., Huddersfield, for the protection of low-pressure vessels supplied with steam through a reducing valve. The relief valve discharges to atmosphere at a set pressure, and simultaneously shuts the steam inlet. It closes again automatically within 5 per cent. of the blow-off pressure and re-opens the steam supply. The valve head fronts on a spindle. Both head and seat are of "Platnam" metal. A handle is provided on the spindle for testing the valve.

A New Griller

The "Lite-on" griller, which is sold in this country by the DOMINION ELECTRICAL CO., 31, Windmill Street, London, W.1, has 250 W elements in both the top and bottom half, so that foodstuffs may be rapidly grilled or toasted on both sides. An adjustable sliding hinge provides for thick meats, "three-decker" sandwiches, &c., and in the open position four eggs and bacon can be cooked. The measurements of the griller, which costs 19s. 6d., are 10½ in. long by 5¾ in. wide when in the closed position.

The "Lite-on" griller

Another new Dominion product is the "Lite-on" pin contact holder for domestic use with flexible. This is an addition to the ordinary strip-lighting holder, and can be used to make an extra "point" or for illuminating gardens, &c.

Hair-drying Equipment

The special features of the new Eugène hair-dryer are the shape of the hood and the method of drawing-in the cold and recirculating the warm air. It comprises an inner cowl mounted in an outer shell and the whole of the appliance, with the exception of the main casting and the motor casing, is manufactured in a special heat-resisting bakelite by Messrs. Thomas De La Rue & Co., Ltd., Walthamstow. The inner cowl and front rim are so constructed and arranged to ensure the actual return of any air across the head through the heating element.

The "Eugène" hair dryer

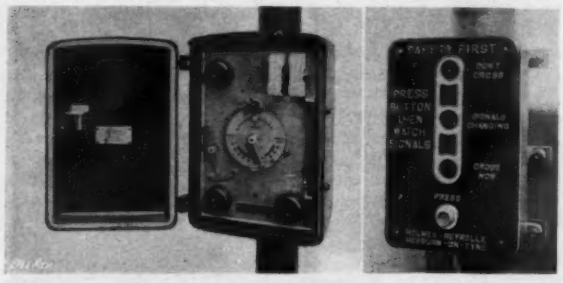
The dryer has a small four-speed universal motor, which is practically silent. The motor and heating are in parallel, so that the element can never be switched on without the motor functioning and thus keeping it to the requisite temperature; both are operated by "Arrow" rotary switches, one controlling the motor and first and second heat, and the other the speed. The apparatus is fitted with a wireless interference suppressor unit and is mounted on a spring-loaded stand, the whole of the metal parts being earthed through c.t.s. cable and a three-pin plug. On 220 V the current rating is 0.4 A, plus first heat, 2 A and second heat 2¾ A, making a maximum total of 5.15 A. The dryer is sold by EUGENE, LTD., Edgware Road, Hendon, N.W.9.

Pedestrian-operated Traffic Signals

Particulars of the new Holmes-Reyrolle pedestrian-operated traffic signal have been sent to us by MESSRS. J. H. HOLMES & Co., LTD., Hebburn-on-Tyne. The components of the equipment consist chiefly of the standard traffic signalling apparatus, an ordinary controller being adapted for pedestrian control by the addition of a pair of auxiliary contacts. The equipment, except for the motor, is suitable for either a.c. or d.c. A complete cycle of the controller can be made to occupy from 30 to 90 sec., and the vehicle amber and red-amber signals each occupy from 6¼ to 13¼ per cent. of the total duration of a cycle, according to their settings. The apportionment of the remainder is also adjustable by steps of five per cent., so that the vehicle green may occupy from 25 to 75 per cent. of it and

the pedestrian green the remainder. The duration of the vehicle amber and red-amber signals can be set independently.

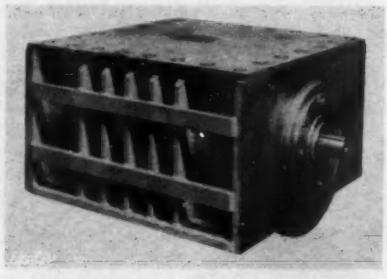
The equipment is mounted on two posts and each carries two three-light lanterns mounted at 180 deg. to each other and one two-light signal at about 90 deg. to the other two.. A push-button box on each post contains miniature signals to show pedestrians how the main signals are set, and vehicular traffic cannot be interrupted for an indefinite period.



The controller and push-button box of the Holmes-Reyrolle pedestrian-operated traffic signals

A Large Coal Cutter Motor

The accompanying illustration shows a powerful flameproof coal-cutter motor supplied by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby. It is of welded-steel construction throughout, and is rated at 100 h.p., 1,470 r.p.m., but it is capable of dealing with overloads of three times that figure. The dimensions are 34 in. by 33 in. by 22 in. high, and it is believed to be the most powerful coal-cutter motor yet built.

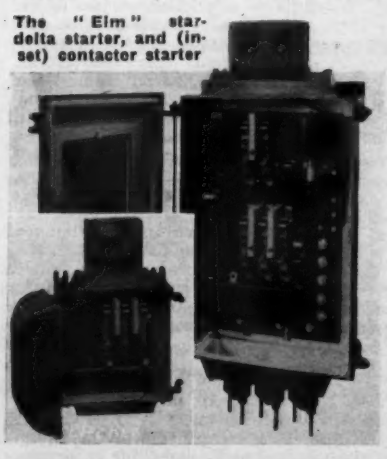


The new B.T.H. coal cutter motor

The stator is wound in a cylinder as a unit, and is assembled from the top. The rotor is easily withdrawable endways by the removal of one bearing cap and four screws, leaving the bearings in position on the shaft. Although the full rating basis is more liberal than that usually adopted for this class of motor, mica asbestos insulation is used. The problems of switching for so large a machine have necessitated the use of double squirrel-cage construction to keep the current within practical limits.

Squirrel-cage Motor Starters

Two "Elm" starters have been designed for squirrel-cage motors by MESSRS. MILNE & LONGBOTTOM, Elm Works, Mere Lane, Rochdale. Both are push-button operated. The star delta model is suitable for motors rated at up to 40 h.p. at 400 V. The contacts make and break with a wiping action assisted by compression springs. Overload protection is by coil and oil dashpot on each phase with integral no-volt release. The automatic sequence relay is instantly adjustable to give a starting period from five seconds to one minute, according to the motor starting load. A mechanical interlock between the starting and running contactors, provides that the contacts shall always maintain their relative positions under all circumstances. The isolating switch is operated from the outside and mechanically interlocked with the cover.



The "Elm" star-delta starter, and (inset) contactor starter

The "Elm 7" automatic contactor starter for squirrel-cage motors up to 7½-h.p. at 400 V, is available for star-delta or direct-on starting, forward and reverse movements, or pole-changing. The push-button switches are mounted on top of the iron case as a separate removable unit. The contactor switch is operated by a coil that gives a definite closing action. It is unaffected by starting surges caused by switching motors on simultaneously. The large contacts, separated by arc shields, make and break with a wiping action, while overload protection is by indirectly heated easily removable thermal units. There is provision for Robinson low-voltage lighting, the control being by a switch mounted in the starter casing.

A Universal Plug

The universal plug introduced by HOOVER, LTD., Perivale, will fit any sized socket, electric power or lighting point, without alteration. It is made principally of rubber, and it is about the same size as an ordinary electric plug. Normally the plug can be stretched to fit any variations in the electric lighting or power point, but provision is made for different amperages by the use of rapidly interchangeable pins which range from 3 to 15 A. There are also two positions in the plug to obviate undue stretching of the rubber when it is desired to change from, say, 5 to 15 A. The plug costs 1s. 8d. and an adaptor, price 10d., is provided to enable the plug to be connected to a lighting socket.

The new universal plug

Non-metallic Gear Material

A recent introduction by BAKELITE, LTD., 68, Victoria Street, London, S.W.1, is "Trefoil," a material suitable for the production of silent gears. It is composed of laminations of specially treated woven fabric impregnated and formed under pressure, so providing an almost homogeneous structure having physical properties in accord with mechanical power transmission. It is a stable and permanent material with sufficient elasticity to absorb shocks and intermittent stresses.

Cut gears or blanks may be stored indefinitely, as atmospheric variations do not produce shrinkage, swelling, or distortion. Oil, water and steam do not impair the true functioning of "Trefoil," and most acids and mild alkalies have no effect upon it. It can be turned, shaped, drilled and milled by standard machine-shop equipment, without special tools. It is supplied in board form 36 in. square in thicknesses from 1-64 in. to 4 in. A special bandsawn-blank service is maintained for the supply of single blanks and special quantities, while particular shapes can be supplied sawn roughly to size.

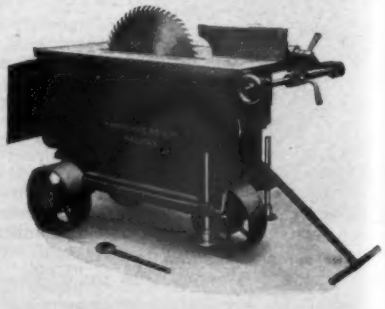
Boiler-scale Removal

For preventing the deposition of or for removing scale from the walls of steam boilers the ANGLO-SWISS ELECTRICAL CO., LTD., 15, Victoria Street, London, S.W.1, has introduced a process known as the "Pulso" which utilises a.c. for the lighting circuits to give a "hammering" action at various local points. It is claimed that the method collects the scale that would otherwise have been formed on the shell in a sandy mess at the bottom, whence it is swept away by the water or removed mechanically.

Portable Timber Cutting Equipment

Those who frequently need to cut up timber, particularly in places where stationary equipment is not installed, as on farms and estates, should find the portable electric saw bench recently introduced by MESSRS. WRIGHT (ELECTRIC POWER SPECIALITIES), LTD., Century Works, Halifax, very useful.

It has been designed to afford maximum strength and rigidity for minimum weight, all the frames being webbed and machine-fitted. The saw spindle, of high-grade steel, runs on ball bearings and it is balanced to run at high speeds without vibration. The table is machined true, and is fitted with a loose gap plate and an adjustable canting fence graduated for bevel cutting. A hand wheel provides fine adjustment. The three-phase 400-440-V 50-cycle standard motor is mounted on the back of the machine, and the drive is by vee rope. The starter is mounted for convenient operation, and no-volt and overload protection are provided.



The Wright portable saw bench

Three sizes of the equipment are available with 22-in., 26-in., and 30-in. diameter saws running at 1,600, 1,500 and 1,400 r.p.m., and driven by 6-, 7- and 8-h.p. motors.

Sales and Service. By R. Wheatley Minter

"High-pressure" salesmen *v.* qualified advisers

IT has been said that in solving the problems of adequate production, equally urgent questions concerning distribution have been created and that the present difficulties experienced in connection with the distribution of apparatus are not associated with production itself. Such, however, is not the case, as these difficulties have largely arisen through the far-reaching effects of misdirected sales activities. So far as electrical apparatus is concerned, the problems of distribution are peculiar to the trade. The goods are constructed for the express purpose of giving personal service and consequently purchasers of electrical apparatus are more critical of it than they may be of their motor cars or their lawn mowers. Should the apparatus cease to function, the failure concerns them more deeply. Hence, the first necessity is to encourage the utmost confidence in the reliable service the apparatus will give.

Two main methods are available for promoting confidence. The goods may be retailed through obviously established and reliable dealers, or sold directly from the factory. Now in times of economic stress (such as now prevail) the first method may not produce results tending to keep pace with production. The problem to be solved is that of sustaining an increasing demand against a rising reluctance to buy. Here again, two means exist for use in this respect; the first is by advertising in selected journals, whilst the other is personal canvassing. One may be as good as the other if carried out with due regard to the nature of the goods themselves. Both, however, can be equally harmful and ineffective.

The problem is really to recognise which plan should be used, having regard to previous activities, and in adapting it to the cardinal fact that a *service* is at stake. Primarily, the apparatus itself will not be bought because of its appearance. Indeed, the appearance of most electrical apparatus is so unimportant that sufficient attention has even not yet been paid to it. Some products, that are peculiarly unattractive, sell well because the service they perform is good. It is, therefore, absurd to waste advertising space to announce that the products are nice to look upon, when a good block inset will do it more effectively and still leave space available for a statement of the services that the apparatus will render. Almost all electrical apparatus has some particular appeal, but a glance through the advertisements of any journal will serve to show how often the opportunity to describe it is lost.

Ineffective Advertisements

Surprising too, is the regular omission of the names and addresses of depôts where the goods may be obtained. Even in localised advertising, this omission is common, but more indefensible. Sales to buyers interested and enthusiastic enough on a first reading to seek out the goods described, will often not pay for the advertisement, much less produce that increased flow of orders essential to the success of the scheme. Frequently these advertisements are not good enough to achieve such ends, but the addition of directions for purchasing would materially assist their purpose.

Another plan is progressively to reduce prices as the season advances. Sales are made until demand falls; upon which, price is reduced sufficiently to reach another stratum of buyers. Consequently, an average profit is produced from a middle price and yearly instead of seasonal trading tends to result. This method is possible, however, only where the goods are themselves seasonal in character: like broadcast receivers, the fashion in which changes annually in some respect. It could not be applied to utensils such as electric kettles, whose characteristics vary little from year to year. The success of this scheme depends upon the ability of the organisation to secure sufficient buyers at the highest price. It is, however, but one step removed from factoring to cut-price stores, whose existence depends upon the anarchy of ill-advised overproduction.

Personal Canvassing

Sales may also be effected by engaging sufficient canvassers. Following a brief initiation into the methods to be used, they embark upon the personally hazardous experiment of trying to earn a living by selling largely on commission. Whilst some very good livings are gained by pure commission selling, not many are in the electrical industry, which exists primarily on service and not through the sale of consumable materials. The sales of individual canvassers may not be many, but in the aggregate they can prove satisfactory, as an adequate supply of unemployed men exists to fill gaps left by unsuccessful salesmen. Born of adverse economic conditions, this method would quickly disappear upon the reduction of unemployment figures to normal proportions.

It has been stated that door-to-door canvassing for the sale of electrical apparatus is inadvisable; but, provided that it is carried out with due care, distinct possibilities exist, equal to those possessed by any other scheme. Most schemes of this nature fail through crudeness; the meat of one class of salesmanship being the poison of another. Such failures are, however, entirely due to the neglect of cardinal principles, where results are sought too hurriedly.

It is inadvisable to begin door-to-door canvassing with apparatus that the general public knows well and can obtain readily in shops, because people do not usually purchase at the door apparatus that they often see in local shop windows. So many ill-advised excursions of this nature have been made (in many trades), that the average householder now heartily loathes the sight of any ordinary canvasser. Consequently, good prospects in this class of campaign probably exist for but two classes of distributors, *i.e.*, those who favour no other means of distribution, and electricity supply authorities. People will receive favourably these visits because they are different; the achievement of a difference being an essential to any successful work.

One of the chief disadvantages attached to personal canvassing as generally practised, is that the canvasser may not possess authority to pledge his employers' word beyond the completion of the sale itself. Generally, any promise made by a canvasser cannot be relied upon, because it is given under duress, to clinch a sale. So far—and with but few exceptions—the idea underlying such canvassing seems to be that the least responsible, lowest salaried, temporary persons possible must be employed and, moreover, those who have least knowledge of the goods to be sold may receive preferences for this work. The rudiments of coercive persuasion having then been mastered, the canvasser begins his work with an attitude more fitted to certain forms of political activity, than to the sale of commodities. His business is to produce results and he tries to do so in accordance with his instructions and ability. Such

These pictures are day and night views of a stretch of the Uxbridge Road, Ealing, which is illuminated by means of centrally suspended electric discharge lamps in Revo "Magnalite" fittings. These were recently installed to the instructions of Mr. R. Birt, the borough electrical engineer of Ealing

a method, is, of course, fundamentally wrong, because it is quite opposed to the laws of ordinary human intercourse.

Electrical undertakings, however, possess, in the principle of personal canvassing, a strong weapon for advancing their load and turnover. Yet the best results can only be expected from unhurried personal visits, by responsible officials, that are of an entirely different character from high-pressure salesmanship. Such visits should be carefully arranged, made after due warning, and preferably by appointment. A large list of visits per day and an equally ponderous order list cannot be produced, but the canvasser must be vested with sufficient authority and knowledge to say "yes" or "no," definitely, about anything connected with the service that he represents. To his hosts, the canvasser becomes the whole authority—or nothing. The visit is wasted if it fails to remove doubts and answer questions, and does not produce amelioration of difficulties, although the alternative is naturally an equally authoritative reply as to why erroneously desired satisfaction cannot be given. Failure to achieve these ends materially lowers the status of the whole service in the minds of those canvassed and retards development.

Representatives with Authority

Obviously, however, casual employés cannot be expected to carry out such work as this and competitions for highest sales commission awards are equally inadvisable, as they militate against the ideas of solidarity and quiet but effective service that must be promoted. Customers have to be brought to understand clearly that a haven of refuge in time of electrical trouble exists ready to their reasoned call and irresponsible high-pressure salesmanship must be banished.

This scheme postulates many differences in conditions as they usually apply. The canvasser (as indicated) must be of a calibre far removed from the generic type of that unhappy name. He must be capable of pledging his employers to all reasoned subsequent service and must, therefore, be capable of finely assessing the merits of such requests, because the immediate settlement of everything discussed at an interview is imperative, the persons interviewed not being interested in go-betweens. Also, the remuneration of such an employé should not depend upon immediate sales effected by his work. Such sales may be few, but analyses of sales turnover in subsequent periods will generally show surprisingly high and persistent advances, that could not be produced by sudden irregular swoops in definitely selected areas by casual canvassers.

Another necessity of such a system is that the canvasser must always be available to those whom he has called upon. In doing his work thoroughly, he will create a personality to whom those he has visited will wish thereafter to appeal. In him will exist the personification of that effectiveness of service that customers understand awaits their call. He must be the holder of watching briefs for both his customers and his employers and has to learn to adjudicate between them. He will, of course, need careful selection, training and direction, but as an intangible, but highly profitable, asset will not be equalled.

Only by the adoption of such methods as this, can the true spirit of electricity—as a service before all else—be fostered in the minds of a people strangely apprehensive regarding its use; their doubts being due largely to ill conceived and irresponsible "sales campaigns."

Indian Electrical Imports

THE survey of the import trade of India during the first six months of the fiscal year (April 1st to September 30th, 1934), prepared by H.M. Senior Trade Commissioner in India and issued by the Department of Overseas Trade, shows that the increase in the total imports of electrical instruments, apparatus and appliances recorded during the first quarter of the year has been maintained, the total value being Rs.130 lakhs, as compared with Rs.108 lakhs during the corresponding period of 1933. The share of the United Kingdom rose from Rs.62¼ to Rs.76 lakhs, that of Germany from Rs.10½ to Rs.14¾ lakhs, the United States from Rs.9 to Rs.13 lakhs, and Italy from Rs.2½ to Rs.4 lakhs. The imports from Japan showed a slight falling-off at Rs.7¼ lakhs, as against Rs.8 lakhs, French imports fell from Rs.1 to Rs.¾ lakhs, and Belgian from Rs.2 to Rs.1 lakhs. Deliveries from Holland remained stationary at Rs.6 lakhs.

An analysis shows that the total trade in electric fans rose from Rs.10½ to Rs.12 lakhs; the imports from the United Kingdom, which decreased slightly in the first quarter, improved during the second quarter and for the six months rose from Rs.7½ to Rs.7¾ lakhs.

Under the heading of electric wires and cables the total imports rose from Rs.30½ to Rs.39 lakhs, the United Kingdom share advancing from Rs.21½ to Rs.31 lakhs, Germany and Japan also showing small increases. The imports from Holland and Belgium declined. Telegraph and telephone apparatus imports increased from Rs.5½ to Rs.8 lakhs, the United Kingdom share rising from Rs.3¾ to Rs.6½ lakhs, and that of "other countries" from Rs.1½ to Rs.1¾ lakhs.

The imports of gasfilled electric lamps rose from Rs.7 to Rs.7¼. Arrivals from the United Kingdom advanced from Rs.3¾ to Rs.4¼ lakhs. Imports of vacuum electric lamps remained stationary at Rs.8 lakhs of which the United Kingdom share was Rs.2¾ lakhs, Holland Rs.2½ lakhs, Japan Rs.1½ lakhs, and the remainder from unclassified sources. The United Kingdom share of imports of automatic electric lamps rose from Rs.2,000 to Rs.4,000, out of a total of Rs.24,000. The bulk of the total of Rs.1¼ lakhs in electric torch lamps was obtained by the United States, the United Kingdom's share being only Rs.1,100. The value of wireless valves imported fell from Rs.30,000 to Rs.26,000, the deliveries from the United Kingdom totalling Rs.19,000.

An increase was recorded in the trade in batteries, the total value rising from Rs.5½ to Rs.6½ lakhs. The United States share was Rs.4½ lakhs, supplies from the United Kingdom increasing from Rs.¾ to Rs.1 lakh. The imports of electric lighting accessories and fittings (including switches) rose from Rs.2¾ to Rs.3½ lakhs, of which the United Kingdom contributed Rs.1½ lakhs, Germany Rs.1 lakh and unclassified countries Rs.¾ lakh. The trade in meters also increased, from Rs.4½ to Rs.6 lakhs, but the United Kingdom share remained stationary at Rs.3½ lakhs.

Electro-medical and Radio Apparatus

Electro-medical apparatus (including X-ray apparatus) totalled Rs.1¾ lakhs, the amount supplied from the United Kingdom being Rs.36,000. Imports of unenumerated electrical goods and apparatus rose from Rs.16¾ to Rs.18½ lakhs, the United Kingdom share advancing from Rs.9¼ to Rs.10 lakhs, that of Germany from Rs.2¾ to Rs. 3¼ lakhs, and the United States from Rs.2½ to Rs.3¼ lakhs.

The total imports of radio apparatus increased from Rs.4½ to Rs.5¾ lakhs, but the report points out that despite the preference arrangements, arrivals from the United Kingdom fell from Rs.2½ to Rs.2 lakhs, whilst those from the United States and the Netherlands showed increases. The Commissioner expresses the hope that United Kingdom manufacturers of radio receiving sets will pay more attention to the needs of this market for cheap sets and set up an efficient distributing organisation. It is confidently expected that there will be a considerable increase in the sales of receiving sets during the next two or three years.

Electrical Imports of Argentina

THE official returns of Argentine imports during the first six months of this year have just reached this country. From these the principal figures relating to the electrical trade have been extracted and are given below, with a note of the increase or decrease compared with the first half of 1933. On the whole the distinct recovery which took place in 1933 has been maintained this year. It will be seen that while imports of lamps and meters dropped, those of cable and wire rose substantially. No details are yet available regarding the shares of the various supplying countries. Values are stated in thousands of gold dollars (at 4s.) according to the valuation of the Argentine Customs Department.

	1934. Jan.-June Gold dols. Thous.	Inc. or Dec. Gold dols. Thous.
Dynamos	540	− 56
Fan motors	15	+ 8
Accumulators and parts	880	+ 152
Batteries	400	+ 38
Ammeters and voltmeters	60	+ 26
Telephone apparatus and material	200	− 20
Radio telephone apparatus	847	+ 220
Receivers	1,548	+ 257
Loud speakers	27	+ 4
Parts for radio-telephones	1,184	+ 24
Radio-telegraph apparatus	15	− 11
Telegraph apparatus	10	+ 7
Switches, circuit-breakers, cut-outs, fuses, etc.	464	− 30
Bells	42	+ 20
Insulating tape	147	+ 7
Change-over switches	120	+ 113
Lamps	906	− 226
Electricity meters	536	− 785
Distribution boards	52	+ 45
Bergmann tubes	45	+ 22
Other insulating tubes	278	− 1
Other electrical material, non-dutiable	41	+ 2
Total of elec. materials not including wire and cable or machinery	8,971	− 14
Cable and wire	2,365	+ 1,438
Electric flex	110	+ 57

A Demonstration House in Dublin. By R. N. Tweedy

SIX miles from the G.P.O., Dublin, 1,500 "subsidy" houses are being finished at the rate of four a week. These sell readily at £650 to £1,500, and should provide a fine load for the big kiosk sub-station erected by the I.F.S. Electricity Supply Board. The Minister for Industry and Commerce recently opened an all-electric house on this estate, which has been furnished and equipped with taste and thoroughness.

This house has one chimney stack, because there is a coal or turf fireplace in one of the two reception rooms, but the builder says that £75 was saved by the elimination of the other stacks which would have been required in an all-fuel house. As the fireplace is in the dining-room it is not likely to be used frequently, even in wintertime, because two heating elements are built into the styles of the fireplace. They will be used rather than the fuel fire at meal-times.

The beautiful design of the drawing-room fireplace, full of glowing warmth when the fire is switched on, should break down the widespread prejudice against any kind of fire which cannot be poked, and does not emit real flames.

The kitchen of this house is almost a replica of the E.D.A. prize design. Instead of the wash-boiler, to which we are not yet accustomed in Ireland, a washer-wringer combination has been fitted. A 12-gal. water heater supplying kitchen, bathroom, and two basins is fixed immediately over the sink. There are no special features about the cooker and the refrigerator, which are amply large enough for their purposes.

At the back door, which opens directly to the kitchen, is an experimental clothes-drying chamber; it would be a coal store in the standard house. About 3-kW of radiant heaters are housed on the floor and covered by a heavy-gauge perforated metal sheet. Air is drawn over the heaters by a box-bladed fan situated at the top of a side wall. The clothes are taken from the wringer to this chamber where they are hung on movable racks. This should solve the problem of drying clothes out of doors on a wet day.

In addition to the clothes-drying chamber there is an electrically heated linen cupboard built into the upper landing. The kitchen and the bathroom are heated by tilting trough-reflector 1-kW fires fixed at ceiling level.

There are about twenty-seven lighting points, ten 5-A and eleven 15-A socket outlets, twenty-three one-way and fourteen two-way switches. A few years ago these would have seemed extravagant figures for a six-roomed house, but there is not one outlet too many for comfort. The lighting is good throughout, perfectly distributed and without glare.

Three views of the I.F.S. Electricity Supply Board's demonstration house, Dublin.

The E.S.B. lost no time after reducing the rates of charge in the Dublin district in bringing to public notice the practicability of the universal application of electricity in the middle-class home. Similar action should be taken on one of the many working-class housing schemes in Dublin, for there can be no doubt that rates which work out at an average cost per kWh of 0.65d. will beat gas on its own ground.

In the Courts

IN the Chancery Division on December 18th Mr. Justice Crossman had before him the case of the National Register of Electrical Installation Contractors *v.* T. Twist & Sons on a motion on behalf of the plaintiffs for judgment on the default of the defendants in entering an appearance.

Mr. H. S. G. Buckmaster appeared for the plaintiffs. He said that the plaintiffs were incorporated for the purpose of providing a register of electrical contractors. The defendant firm was formerly a member. It was a term and condition of membership that application for such membership should be made every year. If a member failed to make that application he ceased automatically to be a member. That was what had happened in the case of the defendants, and they were removed from the Register in October last.

The plaintiffs now brought the present action asking that the defendants, their servants and agents should be perpetually restrained from using on notepaper, invoices, headings or otherwise the standard mark, device or design of the National Register, or in any other manner representing themselves as being registered or as holding a certificate of registration.

The plaintiffs further asked that the defendants should be ordered to deliver up to them, on oath, the certificate of registration issued to them and all dies and blocks and rubber stamps of the said standard mark or device which were in their possession or power.

In the result his Lordship made an order in the terms of the plaintiffs' notice of motion, and directed that the defendants should pay the plaintiffs' costs of the action.

All-electric Flats in Chelsea

In the Chancery Division last week Mr. Justice Eve granted a petition by the Chelsea Electricity Supply Co., Ltd., for confirmation of an alteration of its objects.

Mr. Cecil Turner, for the petitioners, said the main purpose of the alteration was to enable the company to facilitate and popularise the use of electricity by the erection of a block of flats which would be fitted entirely with electricity to advertise its various uses in the home. The company had a piece of land, and it was intended, through a subsidiary company, to erect upon it fully electrically equipped flats.

Business Notes

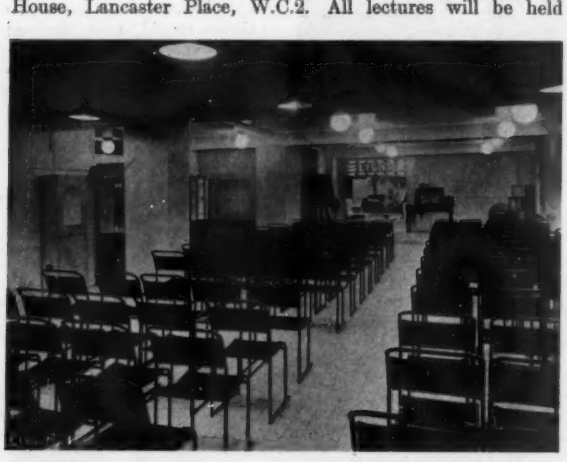
The Week's Electrical Trade News from all Sources. Commercial and Industrial developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidators, and Failures

Employment During November

Employment in the engineering industry during November showed little general change and was moderate on the whole. According to statistics published in the *Ministry of Labour Gazette*, the number of unemployed in the engineering industry totalled 123,914, a decrease of 2,892 as compared with the preceding month, the percentage falling from 13.2 to 12.9 (in November, 1933, the figure was 18.9 per cent.). In the electrical engineering section, however, there was a slight increase, the number of unemployed being 6,420 as compared with 6,271 in October. In the electric cable, apparatus and lamp manufacturing group there was an increase from 9,678 to 10,664, the percentage rising from 7.3 to 8.0 (9.1 in November, 1933). Unemployment in the electrical wiring and contracting industry decreased from 4,423 to 4,215, the percentage being 12.6 against 13.3 in October (14.8 in November, 1933).

The Lighting Service Bureau's Temporary Premises

As a result of the recent fire at Savoy Hill, the Lighting Service Bureau has taken temporary premises in Brettenham House, Lancaster Place, W.C.2. All lectures will be held there until further notice. The accompanying illustration shows the new lecture demonstration room.



The temporary demonstration room of the Lighting Service Bureau

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that there will be no "cost-of-living" alteration in wages paid in the industry on the third pay-day in January.

The Clitheroe Rural Scheme

The Clitheroe electricity undertaking has now completed a rural scheme that has involved the connecting up of nine villages.

The Downham supply was officially switched on by Mr. R. Assheton, M.P., of Downham Hall, on December 15th. The occupant of each of the fifty-one houses in Downham is a consumer.

Cooking demonstrations were held the day previous to the opening, and more than six cookers and four wash-boilers are already in use. Three public street lamps are to be installed. Supply is given from the Clitheroe Corporation's 11,000-V mains. The Downham extension completes the first h.v. ring main which now serves half the area of the undertaking. Supply powers in the rural area were granted to the Corporation under a Special Order in January, 1932, and the whole of the work has been completed in a little under two years, or one year before it was expected. The cables are placed underground in the village of Downham and for half a mile on each side so as to preserve its amenities, and Mr. Assheton has contributed over £1,000 towards the additional expenditure incurred in doing so.

The chairman of the Clitheroe Electricity Committee, Alderman Boothman, J.P., has adopted a progressive policy in extending the supply into the rural area. The entire rural scheme has been carried out by the engineer and manager, Mr. A. H. Todd, at a cost slightly under the original estimate of £25,000. The revenue is almost double and the number of consumers 150 per cent. in excess of the number estimated. Supply is taken in bulk from the Lancashire Electric Power Co.

During the banquet, Sir Wm. Ray, M.P. (executive chairman E.D.A.) completed the ring main by switching on the Downham-Rimington section. He said that in 1927 the Clitheroe undertaking had 112 consumers, but it now had 2,600. It served 150 sq. miles for a capital expenditure of £110,000. Among the other speakers were Sir Thomas Higham (High Sheriff of Lancashire), Mr. A. J. Hutchinson (chairman N.W. District of the Bulk Supply Association), Mr. J. Purrett (Lancs. E.P. Co.), and the Mayors of Clitheroe and Darwen.

The Downham (Clitheroe) sub-station, accommodated underneath the village reading room, which was recently put into commission

Engineering Wage Conference

A conference between the Engineering and Allied Employers' Federation and representatives of thirty-one trade unions was held on December 18th at which the unions submitted a claim to the Federation for an advance of 2d. per hour in wages, and a revision of the 1931 agreement affecting overtime and night shifts. Mr. J. C. Little, president of the Amalgamated Engineering Union, said that the advance would mean a wage increase of from 12 to 20 per cent., and he was of opinion that the increase in production costs was unlikely to exceed 3 to 7 per cent. Mr. A. Ramsey, M.P., the newly appointed Director of the Federation, said that the district association's employers must be consulted and suggested a further meeting early in the New Year, at which a reply would be given.

Australian Tariff Amendments

The Commonwealth Government has made certain amendments in the Australian Customs tariff. A full list of electrical apparatus affected is published in the *Board of Trade Journal* for December 13th, from which it appears that generally the British preferential tariff under the new duties is 30 per cent. *ad valorem*.

Cochranes (Middlesbro') Extension

The plant of Cochranes (Middlesbro') Foundry, Ltd., at Middlesbrough has during the past few years been engaged on making spun iron pipes under licence of the patented Mairy process. Due largely to the increasing demand for the company's products for export, it has been decided to put down a new plant, which will include six further centrifugal machines. It is hoped to have these extensions completed within six months.

The company has opened an office at 16, Deansgate, Manchester, 3, and has appointed Mr. H. S. Davie as sales representative in Manchester and the North West.

Recent Contracts

The decision to convert the Port Jackson & Manly Steamship Co.'s double-ended passenger ferry boat *Bellubera* to Diesel-electric drive with electrical propelling machinery operating on the B.T.H. patented controlled-current system makes this vessel the second to be equipped with this form of propulsion. The first was the *Electric Star*, which operates between Hong Kong and Kowloon.

The *Bellubera* is one of six double-ended passenger steam ferry vessels running in Sydney Harbour. The Diesel-electric equipment for the *Bellubera*, for which the British Thomson-Houston Co., Ltd., are the main contractors, will comprise the following: Four five-cylinder Harland & Wolff two-stroke engines each rated at 400/450 b.h.p. (600 r.p.m.) and coupled to a B.T.H. d.c. generator rated at 320 kW; four 615-h.p., 790-r.p.m. propeller motors; two sets of single-reduction double-

pinion helical gears with combined Michell thrust blocks, lubricating oil pumps and coolers to suit a motor shaft speed of 790 r.p.m. when delivering 1,230 s.h.p. at 158 r.p.m. at the propeller-shaft coupling; and two bridge control stations. In addition, there will be supplied the usual switchgear, auxiliary generators and emergency engine-room control station provided with this type of equipment.

Sir W. G. Armstrong Whitworth & Co., Ltd., of Scotswood-on-Tyne, have received an order for the supply of ten Diesel-electric shunting locomotives for the London, Midland & Scottish Railway. Each locomotive will weigh fifty tons and the order is valued at £100,000.

Dutch Lamp Import Quotas

The existing quota system for the import of metal-filament lamps into Holland has been extended for six months as from November 1st. The Minister for Economic Affairs is reported to have stated that the measure has for the most part met expectations, and that the reasons for its introduction continue to apply. The permissible imports, which are equal for all countries, have been fixed at 50 per cent.

The German Cable Industry

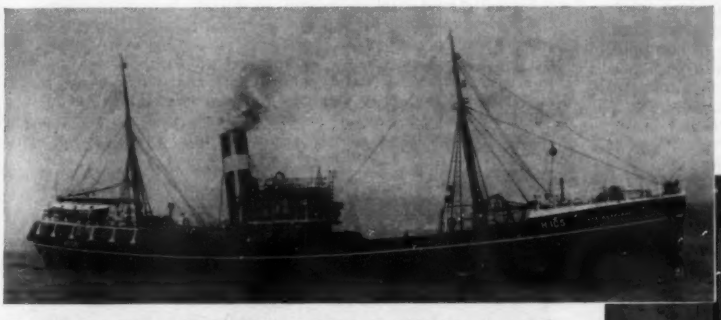
Since the beginning of last year the German cable industry has improved. The home turnover has been increased by 60 to 80 per cent., and large extensions of Government schemes are in contemplation. The export trade has also improved in recent months, large deliveries having been made to Holland, Rumania and China.

Special Lighting at Portsmouth

Illuminations on an elaborate scale were carried out in Portsmouth and Southsea during last week. The "Beeantee" Illuminations, Ltd., provided a considerable quantity of material for the scheme, including about 6,000 holders and lamps, cable, and a large number of electrical novelties, including Union Jacks, butterflies, and peacocks.

Social Events

The Christmas festivities of the Social and Athletic Club of the Midland Electric Manufacturing Co., Ltd., were held recently. A dinner and smoking concert for the foundry workers was held on December 15th, about 120 being present.



The trawler "Cape Barfleur," and the distribution board in the bridge house

During the proceedings Mr. W. L. Barber, managing director, presented gold watches to those who had this year completed ten years' service with the company. Eleven gold watches were presented. On December 18th there was a dinner and dance for the pottery, main works, and office staff sections at the Masque Ball Rooms, at which about 300 were present. On this occasion a further thirteen gold watches were presented, making twenty-four for the current year. Mr. Barber pointed out that this year's presentation brought the total number of the "gold watch brigade" up to eighty-eight.

The J. & P. Sports Club (Johnson & Phillips, Ltd.) held its 12th annual dinner at the J. & P. works hall at Charlton on December 14th. About 260 members of the staff, the works, and engineers from outside contracts all over the country gathered at the headquarters of the Club. Mr. H. J. Sheppard, managing director of the company and founder of the Club, was absent owing to illness, and Mr. C. Stewart took the chair, supported by the vice-presidents of the Club. After dinner the company was entertained by well-known radio artists, and the evening ended with seasonable jollification, Mr. W. Smith, the hon. secretary of the Club, receiving praise for his efforts in arranging a successful function.

The employés of Siemens lamp works, Preston, produced a revue, entitled "Light Without Glare," in Bairstow Street Schools, Preston, on December 12th, as a result of which fifteen guineas was handed over to the local infirmary. Last year a sum of ten guineas was raised by the same means.

Technical Advertising

At the Publicity Club, Nottingham, on December 17th Mr. Lewis Hart, publicity manager to the Brush Electrical Engineering Co., Ltd., Loughborough, delivered an address on the organisation and management of an advertising department without the aid of an advertising agency. Mr. Hart, whose chief experience has been gained in connection with handling engineering products, dealt with Press advertising, direct mail, catalogues, photography and various aspects of the subject.

Floodlighting Regent Street

The Regent Street Association proposes to floodlight Regent Street buildings as part of the King's Silver Jubilee celebrations next year. According to the *Daily Telegraph* the Association states that a temporary scheme is not contemplated; it is intended that it should be in operation for at least three and a half years. The Westminster City Council Works Committee has recommended to the Council that every possible facility should be afforded the scheme, and the Committee's recommendation has been adopted by the Council.

Spanish Import Quotas

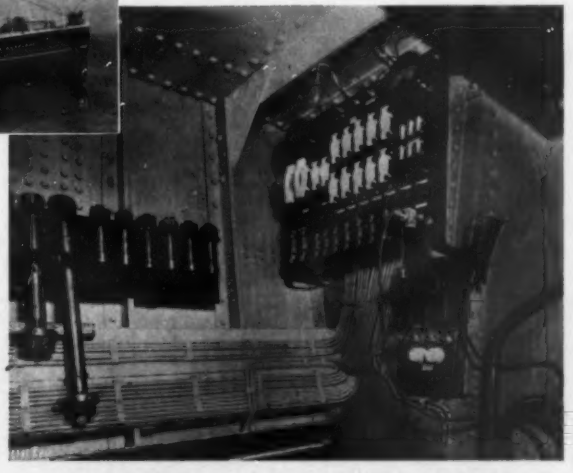
The Commercial Counsellor to H.M. Embassy at Madrid reports that the total import quotas, for the year 1935, have been fixed for certain goods. These include the following:—Diesel and semi-Diesel engines, weighing up to 10 metric tons, 14,510 metric quintals; dynamos, electric motors, alternators, transformers, magnetos, starters, rheostats, &c., weighing from 25 to 100 kg. each, 2,050 metric quintals. According to the *Board of Trade Journal* the allocation of the total quota among the various supplying countries will take place later. It should be noted that certificates of origin are required for all goods subject to quota.

Christmas Illuminations

Special illuminations were arranged by the Clacton Urban District Council Electricity Department during the busy Christmas shopping season. Mr. G. Broadhurst, the electrical engineer and manager of the undertaking, informs us that about 2,000 lamps were erected in the shopping centre and the principal thoroughfares.

Electrical Equipment on a Trawler

The *Cape Barfleur*, which was built by Messrs. Cochrane & Sons, Ltd., and is owned by Messrs. Hudson Bros. Trawlers, Ltd., Hull, is one of the fastest and largest trawlers afloat and was specially designed for carrying a heavy load, her capacity being 300 tons of coal and 90 tons of ice. Her triple expansion engines develop 800 h.p., and Messrs. Wm. Broady & Son, of Hull, were responsible for the electrical installation and equipment. This is the twenty-fifth vessel Messrs. Broady have wired during the last two years, and in each case Henley cables have been used. On the *Cape Barfleur* approximately 2,000 yds. of Henley lead-covered and armoured and plain lead-covered cable were installed. Among the



amenities aboard this trawler are a wireless installation, electric fire, and a modern bathroom with hot and cold water in the skipper's quarters. The vessel is equipped with Marconi depth-sounding apparatus and wireless. In the fish-room the cables have to work under very bad conditions, the compartments being packed with fish and ice almost to the deck when the ship returns to harbour from a voyage of some weeks. Watertight fittings are, therefore, necessary. Temperature conditions in the engine room, where the main distribution board shown in the accompanying illustration is situated, are opposite to those in the fish-room, and the cables have to withstand conditions of heat, with steam in the atmosphere. The distribution board in the bridge house was specially designed and manufactured by Messrs. Wm. Broady & Son, and is an improvement on the old type of board. This board is on the inner side of the bridge house behind the helmsman and in conditions where the temperature remains practically constant. Each half of the board, with the slate base, can be opened outwards, and behind are the cable ends in a teak box. At the back of the switchboard, which is practically airtight, is another partition which is caulked. On the front

are two other doors which help to shut out the atmosphere from the board. The cables on this trawler are arranged behind panelling, sections of which can be removed. This arrangement ensures that practically every part of the cable is immediately accessible.

A Demonstration Van

The accompanying illustration shows a new demonstration van for the Ringmer and District Electricity Co., Ltd., a subsidiary of Messrs. Johnson & Phillips, Ltd. The van is carried

The demonstration van of the Ringmer Company

out in four tones of green, with the cooker, water heater and electric iron in their natural colours. The company has found this van particularly useful for demonstration work, especially where cookers, &c., are to be used or shown to present or prospective consumers.

Trade Announcements

The business of Messrs. Wm. Sanders & Co. will be taken over by Messrs. Wm. Sanders & Co. (Wednesbury), Ltd., as from to-day (Friday). Invoices and accounts rendered after to-day will be taken over and paid by the new company.

Wright (Electric Power Specialities), Ltd., has appointed Mr. J. B. Wilson, A.M.I.M.E., as its sole agent for Scotland, and has opened an office at 45, Hope Street, Glasgow, C.2.

Mr. W. C. Mercer has taken over the business of Baxters Garage, Rotherham Road, Maltby, and asks for lists of cables, lighting accessories, wires for magnetos, radio sets and components, &c., and display material.

General Resistors, Ltd., has removed to 175, Windsor House, Victoria Street, S.W.1. (Telephone: Victoria 0782.)

As announced in our issue of November 30th, page 772, G.V.D. Illuminators, the business founded by Mr. G. V. Downer, has been formed into a private limited company, G.V.D. Illuminators, Ltd. Mr. Downer is managing director and chairman.

Messrs. Elliston, Evans & Jackson, Ltd., have removed to 27, Ray Street, E.C.1. The telephone numbers remain unchanged.

Messrs. L. Benn & Co., Ltd., have removed to 80, City Road, E.C.1 (telephone: Clerkenwell 5112-3).

Calendars, Diaries, etc.

We welcome the season's greetings from Venner Time Switches, Ltd., of Kingston By-pass Road, New Malden, with unusual interest, because they take the form of a neat little key chain. More years ago than we care to remember a similar memento was received from the same company, and we have carried it ever since; lately it has shown signs of wear and we replace it with pleasure.

The calendar of British Insulated Cables, Ltd., is in the familiar form of preceding years, and shows past and following months and also the previous and following years.

Some excellent views in and around Rugby, taken by the company's staff photographer, illustrate the calendar of the British Thomson-Houston Co., Ltd., which shows three months on each sheet.

Monsal Dale, Bakewell, makes a pleasing picture for the calendar of the D.P. Battery Co., Ltd.

The calendar of Messrs. Lionel Robinson & Co. bears an etching of 3, Staple Inn, W.C., one of London's picturesque gabled buildings, and the address of the company.

"There ain't going to be no core," is the title of a finely coloured picture of a young rascal sampling a bag of apples, which makes a tasteful calendar sent us by Messrs. G. E. Wallis & Sons, Ltd.

The calendar of Messrs. Blackstone & Co., Ltd., which has monthly sheets, is illustrated with pictures of some of the company's products.

Messrs. Landis & Gyr, Ltd., have sent us a refill for their desk calendar.

A neat pocket-size loose-leaf notebook has been received from Aveling-Barford, Ltd. This has celluloid covers with a calendar for 1935 and the first quarter of 1936 on the back.

Twelve humorous drawings in colour by H. M. Brock illustrate the well-produced calendar of the County of London Electric Supply Co., Ltd., which has monthly sheets. These drawings purport to depict famous historical episodes and what might have happened if electricity had been available.

The wall calendar of Messrs. Craven Bros. (Manchester), Ltd., has large monthly sheets which also give the preceding and following months in bold figures. Each sheet bears an illustration of one of the company's products.

Some excellent views of the Swiss Alps are a feature of the calendar of British Brown-Boveri, Ltd., which also includes vignettes illustrating some of the company's products.

Wiring, Ltd., has chosen for its calendar "The Old Curiosity Shop," a handsome reproduction from the original by A. de Breanski, Junr.

The wall calendar of Messrs. T. J. Grainger & Co., Ltd., has large daily slips, with bold red figures.

Mr. Samuel Baxter's calendar has monthly slips with bold figures in red and black.

The picture chosen by the Thames Board Mills, Ltd., for its calendar is an artist's impression of the Rest Garden at Thames Mills, Purfleet, Essex.

We have also to acknowledge cards conveying the season's greetings from a large number of our readers and desire to convey our thanks and best wishes to them.

Prices of Materials

Messrs. F. Smith & Co., report December 24th: No change in the price of electrolytic copper bars, wire rods, and h.c. and silicium bronze wire.

Messrs. James & Shakespeare report, December 24th: Copper bars (best selected), sheet and rod, no change. Copper (electrolytic) sheets, £31 5s. to £31 15s., 5s. decrease. English pig lead, £12 5s., 5s. decrease.

Trade Commissioner Appointed for Calcutta

The Department of Overseas Trade announces that Mr. A. Schofield, at present serving as assistant to H.M. Trade Commissioner at Bombay, has been appointed H.M. Trade Commissioner at Calcutta, to fill the vacancy caused by the transfer of Mr. R. B. Willmot to Singapore. Mr. Schofield will take up his new duties early in February.

Architectural Tubular Lighting

Striking modernistic lines in good taste reveal themselves in the new showrooms of the architectural tubular lighting which have been opened at 23, Panton Street, Leicester Square, by Tubelight Sales, Ltd. The method of supporting the filament of the lamps enables almost any shape to be made with ease, a fact which is admirably demonstrated by the fittings on the walls. A specially attractive feature is the two circular mirrors ringed around with a tubular light, while the modern

The new Tubelight Sales showrooms

tubular furniture and spaciousness of the showroom showed up the lighting to its best advantage. The architect was Mr. O. P. Bernard. This lighting was described in our articles on the Cumberland Hotel and Grosvenor House.

I.F.S. Lamp Import Tariff

In Dail Eireann recently, on the Committee stage of the Imposition of Duties (Confirmation of Orders) Bill, 1934, an amendment was moved by Deputy R. Mulcahy to delete the duty of 75 per cent. on imported electric filament lamps of not more than 300 watts. The Minister for Industry and Commerce, Mr. S. Lemass, in opposing the amendment, explained that until now normal requirements of these lamps were being imported free of duty under licence. There would be no increase in price of such lamps because the concern erecting the factory in the Free State had agreed on that. It was anticipated that this new factory, which was being established at Bray, County Wicklow, would come into production early in the New Year, and the duty would operate simultaneously. Deputy G. O'Sullivan asked the Minister if the duty would make these lamps more expensive. The Minister

replied that if the undertaking given by the firm manufacturing the lamps that there would be no increase in the price were departed from, the Government would have to consider very seriously the removing of the duty, and adopting some other action. There would be no increase in price. The amendment was defeated by 38 votes to 22.

An Advertising Exhibition

At the Regent Exhibition "Advertising of To-day and To-morrow," held recently at Dorland Hall, new methods of advertising were shown including a talking poster, which was fitted with a powerful loud speaker, and a message was

A stand at the Advertising Exhibition showing the talking poster

delivered at intervals. The advertisers were Messrs. Marryat and Scott, Ltd. Our picture shows the stand, which was of modern and original design by André Bouxin and A. V. Pilichowski. The exhibition included posters of all countries, photographs, talking films and models of buildings of the future.

For Sale

Spenborough U.D.C. has for disposal two 300-kW rotary convertors, one d.c. feeder board, circuit-breakers, and other electrical plant.

The West Central Merchandise Mart will sell by auction on January 9th at Torrens Street, Islington, N.1, stock of the Leeds branch of the Unity Lamp & Accessories Co., Ltd.

(See our classified advertisements.)

Domestic Science Awards

On December 21st the London School of Electrical Domestic Science brought its first year to a close by presenting twenty certificates to successful students before a large gathering of interested visitors. Seven certificates were gained by students for the theory and practice of electricity in domestic science, and thirteen for the theory of electricity as applied to housecraft. These were presented by Lady Snell, who, in the course of her address, said that the students were still among pioneers in the uses of electricity and congratulated them upon the opportunity they had received from such a training. The Principal, Miss H. Minoprio, gave a brief summary of the rapid growth of the school, and said that nine of those who had trained with her were now leaving and ready for posts. She reminded her audience that in addition to the day courses and a one-week intensive course held in the summer for those in the electrical industry, evening classes in cookery, theory of electricity, and voice production were available. Mr. A. C. Cramb, of E.D.A., proposed a vote of thanks to Lady Snell, and said that he considered Miss Minoprio was doing good work for the industry, which the E.A.W. and his Association recognised and appreciated. He felt that students had a unique opportunity in the training offered by the London School of Electrical Domestic Science. Attractive Christmas cakes were on show and the students, who had decorated the school premises and prepared the tea, assisted the staff in entertaining their guests.

Railway Goods Yard Lighting

The L.N.E.R. yard at Niddrie West, Edinburgh, has recently been illuminated by a number of G.E.C. floodlights equipped with 500-W "Osram" lamps. This installation follows similar schemes carried out at other railway centres, among which are the Cockfosters station of the London Passenger Transport Board, Temple Meads, Bristol, and Grimsby Docks.

New Catalogues and Lists

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—A leaflet on 10- to 35-kW electrode steam raisers.

Nox Electric Lamp Co., Ltd., Clarence Road Works, Hunslet, Leeds.—A catalogue of electric lamps.

Ozalid Company, Ltd., 1, Central Buildings, Westminster, S.W.1.—Particulars of "Ozalid" dry developed photo-printing papers.

British Sangamo Co., Ltd., Cambridge Arterial Road, Enfield.—A complete general meter catalogue on art paper, profusely illustrated.

Radiovisor Parent, Ltd., 28, Little Russell Street, W.C.1.—Four leaflets on counting apparatus, turbidity control and other light-actuated apparatus.

Bankruptcy Proceedings

L. C. Merrison, Radio House, High Street, Bushey, radio and electrical engineer.—The public examination of this debtor was continued at the Court House, St. Albans, recently. It was disclosed that the gross liabilities were £1,004, of which £985 was expected to rank for dividend. There were assets of £19, but they were absorbed by preferential claims, leaving a deficiency of £985. Debtor commenced trading in 1928 at Bushey. In 1931 he started dealing in radio receivers and components, and removed to larger premises. He obtained a bank overdraft of £150. In December, 1932, debtor arranged with another that the latter should sell wireless receivers for him on a commission basis. By February, 1933, debtor's agent owed him £366, which had to be written off as a bad debt. In April, 1933, debtor called a meeting of creditors whose claims amounted then to £1,250. A composition of 5s. in the £ was accepted and subsequently paid. Debtor continued the business, but since early this year it had declined. The landlord distrained for rent, and another creditor levied execution and the whole of the stock was sold. Debtor attributed his failure to the bad debt of £366; keen trade competition; and insufficient profits to cover expenses and personal drawings. The examination was further adjourned.

J. E. Madden, 113, Bradford Road, Huddersfield, wireless dealer.—The public examination was held recently at the County Court, Huddersfield, when it was stated that the ranking liabilities amounted to £750, and there were net assets of £318, leaving a deficiency of £432. Debtor said he commenced business in February, 1930, with borrowed capital, some of which he was able to repay from the subsequent profits of the business. Eventually debtor executed a deed of assignment, to which one creditor would not assent, and the present proceedings ensued. The failure was attributed to shortage of capital and bad debts. The examination was closed.

W. J. Davies, 230, Great North Road, Woodlands, near Doncaster, Yorkshire, radio and electrical engineer.—The first meeting of creditors herein was held at the Official Receiver's offices, Figtree Lane, Sheffield, recently. A statement of affairs was submitted which showed unsecured liabilities of £393, with a deficiency of 14s. Debtor attributed his failure to trade depression. The creditors appointed Mr. F. E. Bendall, accountant, 27, York Street, Sheffield, as trustee of the estate.

R. S. Barlow, electrical contractor and radio dealer, Chapel Lane, Spalding.—Receiving order made December 17th on debtor's own petition. First meeting January 1st at 41, Sidney Street, Cambridge. Public examination January 25th at the Law Courts, Peterborough.

W. H. Tweedle (Premier Radio and Electrical Supplies), radio engineer and dealer, Paddock Head, Paddock, Huddersfield.—Trustee, Mr. J. O. Morris, 71, Manningham Lane, Bradford, Official Receiver, released December 12th.

A. Senior and **H. Senior** (A. Senior & Son), electrical contractors, Back North Terrace, Darlington.—Trustee, Mr. C. L. Townsend, 80, High Street, Stockton-on-Tees, Official Receiver, released December 12th.

J. Vigon (Modern Electrical Installations), electrical and radio engineer, 355, Commercial Road, E.—Last day for receiving proofs for dividend January 4th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

R. B. Emerson, electrical engineer, 330, London Road, Westcliff-on-Sea.—First and final dividend of 2s. 6d. in the £, payable December 28th at 3, Cannon Street, E.C.

B. S. Jones (North Wales Battery Service), Buxton House, Barmouth.—Last day for receiving proofs for dividend December 28th. Trustee, Mr. H. W. Thomas, 4, Queen Street, Carmarthen, Official Receiver.

A. E. L. Trebilcock, wireless dealer, Holyrood Street, Chard.—Last day for receiving proofs for dividend December 29th. Trustee, Mr. W. R. Cocks, Exeter Bank Chambers, Broadgate, Exeter, Official Receiver.

A. J. Harding, electrical engineer, 50-51, Broad Street, and at West Street, Hereford.—First and final dividend of 2s. 3d. in the £, payable December 29th, at 133, St. Owen Street, Hereford.

Company Liquidations

Thompson Ritchie & Co., Ltd., Buckingham Gate, S.W.1, electrical engineers.—A meeting of creditors was held recently at Winchester House, Old Broad Street, London, E.C., when no statement of affairs was presented, but it was reported that the unsecured liabilities amounted to £1,932, and the assets consisted of cash in hand £405, leaving a deficiency of £1,527. It was stated that the firm was founded in 1892 with a nominal capital of £5,000. The capital had been increased from time to time. Debentures were issued to the extent of £3,600 which, by 1928, had been reduced to £1,500, but a further issue was made in order to raise money for the purposes of carrying on the business. The company became dormant and had remained so since August, 1933, and endeavours had been made to sell the freehold property in order to repay the debentures. Eventually a sale was effected, and there was an excess of assets available for the unsecured creditors. It was decided that Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, should be appointed liquidator of the company with a committee of inspection.

Lamplugh Radio, Ltd.—Particulars of claims by January 19th to Messrs. F. E. Bendall and C. E. Lucas, liquidators, 1, Lansdowne Place, Warwick Road, Coventry.

Private Arrangement

C. W. Solly, 1s, Vicarage Road, Eastbourne, electrical and radio dealer.—A meeting of creditors was held on December 14th, at the offices of Mr. A. E. Orbell, 6-7, Old Steine, Brighton, when a statement of affairs was submitted which showed ranking liabilities of £150, all due to the trade. In addition, there were fully secured creditors for £421 who held security valued at £600. The assets totalled £189, leaving a surplus of £39. Mr. A. E. Orbell reported that a distress for rent had been levied, and it was not anticipated that the sale of the stock and effects would produce more than the amount outstanding for rent. It was decided that the matter should be dealt with under a deed of assignment to Mr. A. E. Orbell, with a committee of three of the principal creditors.

Electricity Supply

Lighting, Domestic, Power

Afghanistan.—WATER POWER PROJECT.—The Government is to undertake a hydro-electric project to supply energy to Jalalabad. The power, it is understood, will be derived from the Seraj Canal. Although the scheme will start in a small way, it is proposed to extend it at an early date.

Bangor.—POWER PLUGS.—Mr. Price White, electrical engineer, recently reported to the Council with regard to the installation of power plugs in Council houses. He estimated the cost at 25s. for the first plug and £1 for additional ones. Opinion was divided as to whether the Department should afford such facilities to tenants, and it was decided that the electrical engineer should confer further with the surveyor.

Barnes.—NEW PLANT.—The Electricity Commissioners have consented to the application of a sum not exceeding £4,578 from the net surplus of the Corporation Electricity Department for the year ended March 31st last, for the erection of the Tangier Road sub-station, plant, mains, and switchgear.

Barnet.—STREET LIGHTING.—The work of replacing gas lamps by electric ones is to be put in hand immediately, and ninety-two additional electric lamps are to be provided at a cost of £337 per annum.

Barrow (Leicester).—OVERHEAD LINES.—The Rural District Council is opposing a proposal of the Electric Power Co. to use overhead lines for supplying a number of villages.

Bath.—ALLOCATION OF PROFITS.—Of the £24,543 profit made by the Corporation electricity undertaking last year £8,100 has been allocated to the relief of the rates and £10,400 to reductions in electricity charges.

Blackpool.—PROGRESS.—In Blackpool there are now more than 30,800 users of electricity, the Electricity Department having registered 2,510 new consumers within the past eight months. Favourable comment has been made on the new electric lighting system for the stalls in the Prescot Market Square. There are six lamps to each stall and special precautions have been taken to render the installation shock-proof. Oil lamps were previously used for lighting the market.

Bredon.—NEON CHURCH CROSS.—A neon cross, believed to be the first of its kind in the country, has been erected on the parish church.

Bromley (Kent).—WIRING CONTRACTS.—A considerable increase in wiring and contracting work led the electrical engineer to apply to the Electricity Committee for instructions as regards applications for wiring under the Council's hire arrangements. It was decided that in the event of an applicant desiring to place the work with an approved contractor at a price not exceeding that at which the Corporation is prepared to execute the work, the Council shall entertain the application, provided the work is carried out to the Corporation's specification and the cost of the inspection of the installation is paid by the applicant.

NEW TARIFF.—A special water heating tariff at ½d. per kWh, to be measured by a separate meter, is being introduced.

Burton-upon-Trent.—SUB-STATION.—The Electricity Committee is to erect a sub-station at Lichfield Road, Branston.

MAINS EXTENSIONS.—A request has been received for the extension of mains in Dag Lane, Overseal.

Carlisle.—EXTENSIONS.—The Council is to extend mains in the city area (£677) and in the rural area (£1,818).

Carnforth.—STREET LIGHTING.—The Urban District Council has received sanction to a loan to cover the cost of converting the public lamps from gas to electricity. Energy will be obtained from the Westmorland & District Electricity Supply Co.

Charndon.—SUPPLY INAUGURATED.—The village has been provided with a supply of electricity.

Consett.—CENTRAL POWER STATION.—A scheme has been prepared for the construction of a central power station to supply Consett, Benfieldside and Leadgate.

Doncaster.—ILLUMINATIONS.—Alderman H. M. Marshall, chairman of the Electricity Committee, switched on the four miles of special street illuminations which were arranged in conjunction with the local Chamber of Trade to make the town attractive for the Christmas season.

Dorchester.—HEATING TARIFFS.—The Town Council has instituted a heating tariff for places of worship at 0.6d. per kWh on Sundays, and 2d. on other days. A supply has been offered to the Dorset Public Assistance Committee for heating new casual wards in the town at 0.75d. per kWh for off-peak periods, and 2d. per kWh during restricted hours.

Farnham.—SUPPLY TO COUNCIL HOUSES.—The Urban District Council has consented to the Electric Light Co. supplying electricity to council houses at Boundstone and to the Badshot Lea recreation ground pavilion.

France.—ELECTRICAL DEVELOPMENT.—Both the Loire et Centre Electric Co. and the Ouest de la France Co. show an increase in profits for the year 1933-34 over the previous twelve months, reports our Paris correspondent. The latter company's output increased from 16,000,000 kWh to well over 17,000,000 kWh. There is a good deal of development in small hydro-electric plants throughout the country. A station has recently been completed on the Grandrif fall in the Puy de Dome Department. Reconstruction of the distribution network in Orléans is being proceeded with. Three local distribution sub-stations of 400 kVA have been built and seven more are contemplated. This work, together with the replacing of the cables, is not expected to be finished until 1940. In the course of his address as the new President of the Syndicat Professionel des Producteurs et Distributeurs d'Energie Electrique en France, M. Pierre Caillaux stated that whereas in 1929 the installed generating capacity throughout the country amounted to only about 3,200,000 kW, it had now reached 5,600,000 kW, an increase of 75 per cent. During the same period the annual sales of power had increased by 52 per cent., from 8,000,000,000 kWh. He added that a supply of electricity was now available to 96 per cent of the population of the country.

PARIS SUBURBAN DEVELOPMENT.—Three of the large Paris electricity supply undertakings have lately joined together in the formation of a separate company with a capital of ten million francs, and the title of La Société Parisienne d'Interconnexions Electriques, the purpose of which is to erect and operate a 220,000-V power distribution system, partly overhead and partly underground, in the outer suburbs of Paris.

Gravesend.—IMPROVED LIGHTING.—For improving the lighting in High Street., fourteen centrally suspended lamps are to be provided.

Greece.—LIGHTING OF ATHENS.—An agreement has been concluded with a British firm, operating under the name of the Athens Piraeus Electrical Co., for the lighting of the city. The agreement is for a period of six years, and the company is to install 1,400 new lamps.—*Reuter.*

Guildford.—SUPPLY EXTENSION.—The Electricity Committee recommends the provision of a supply to eighty houses in course of erection at Barnett Hill (£1,360).

Heighington.—VILLAGE LIGHTING.—The clerk to the Council has been instructed to obtain particulars regarding the lighting of the village streets.

Hove.—SUPPLY TO SANATORIUM.—The Town Council has accepted the offer of Brighton Corporation to give a supply of electricity to the sanatorium.

Knighton (Shropshire).—MAINS EXTENSIONS.—The Shropshire, Worcestershire & Staffordshire Electric Power Co. is to extend mains in Penybont and Knucklas Road.

London.—ISLINGTON.—On December 18th there was a failure in the electricity supply in Islington, some premises being affected for three-quarters of an hour and others for periods up to two hours. At the Royal Northern Hospital an operation was being performed when the failure occurred. "Keepalite" (Exide) emergency lighting was automatically switched on, enabling the operation to be continued. In the case of the London Fever Hospital auxiliary plant was brought into use within two minutes.

DEPTFORD.—The Borough Council is to substitute electricity for gas in St. Donatts Road, Clifton Hill, Woodpecker Road and Trundieys Road, New Cross.

ST. MARYLEBONE.—The Electricity Committee reports that the change-over from fuel to electric heating at the Town Hall has now been in operation for a year, the consumption recorded being as follows: Central heating, 420,280 kWh, and domestic water supplies, 75,743 kWh. At the standard tariff for storage supplies of this character the cost compares favourably with the cost of fuel firing for previous years, and the Committee thinks that it is generally conceded that there has been an appreciable improvement in the heating services.

POPLAR.—The Electricity Committee is seeking sanction to borrow £3,900 for a new switchboard at Glaucus Street Station.

FULHAM.—The Electricity Committee has obtained sanction to borrow £5,000 for domestic apparatus.

SHOREDITCH.—The Housing Committee recommends the installation of electric wash-boilers in a number of the Council's houses.

STEPNEY.—The Electricity and Public Lighting Committee recommends that an optional rate of charge for large consumers shall be introduced. It will be £5 per kW of maximum demand to cover lighting, heating and power (subject to a minimum payment of £800 per annum) with a running charge of ¼d. per kWh for electricity consumed. An oil-driven house set costing £848 is recommended for the King's Road Station, and mains are to be extended at a cost of £430.

STOKE NEWINGTON.—The Electricity Committee has received sanction to a loan of £2,147 for mains and services.

Madeley.—BUILDWAS STATION EXTENSIONS.—Extensions of the Buildwas power station are to be carried out next spring to provide for new plant. The chimneys are to be raised 75 ft.

Manchester.—LIBRARY PERMANENTLY FLOODLIGHTED.—We are informed by Mr. H. C. Lamb, chief engineer and manager of the Electricity Department, that the imposing new public library is being permanently floodlighted. There are 56 bays in the colonade, each approximately 27 ft. high and 10 ft. wide. The total area is illuminated by 180 100-W lamps, and the effect is very striking.

Morpeth.—SUB-STATION.—The Town Council has approved

a plan by the North-Eastern Electric Supply Co., Ltd. for a sub-station at East Riding.

Norwich.—LOAN.—The Electricity Committee is seeking santion to borrow £30,000 for transformers, sub-station equipment, etc.

Plymouth.—FLOODLIGHTING.—Parts of the Guildhall and Queen Victoria Jubilee memorial are being floodlighted. Red lighting is used on the imposing facade of the Guildhall, and ordinary lighting for the monument, providing an effective constrast.

Poland.—MORE CONSUMERS.—The six electricity supply undertakings affiliated to the Société des Entreprises Electriques en Pologne are now supplying power to a total of 59,320 consumers (2,066 more than a year ago). The load on the stations has increased from 38,282 to 43,387 kW.

Poulton-le-Fylde.—REMARKABLE PROGRESS.—At Poulton-le-Fylde (population 3,366, 1931 Census), 1,055 residents are now supplied with electricity by Blackpool Corporation. The service has not long been installed.

Rumania. — ELECTRICITY SUPPLY PROGRESS. —According to an article in the *Electrotechnische Zeitschrift* of the 177 electricity power stations giving a public supply at the end of last year, 96 plants were producing a.c. and were responsible for 88.5 per cent. of the output. The output amounted to 334.5 million kWh as compared with 322.1 million kWh in 1932. A plant capacity of 130,000 kW is operated by steam, 54,800 kW by internal combustion engines and 27,200 kW by water power.

St. Asaph.—OVERHEAD LINES.—The Rural District Council has decided to raise no objection to the Electricity Distribution of Wales, Ltd., erecting overhead lines for supplying Rhydyfoel.

Skipton.—EMBSAY LIGHTING.—The Rural District Council has approved a quotation of the Electrical Distribution of Yorkshire, Ltd., for street lighting at Embsay.

TENDERS FOR WIRING.—The Rural District Council has instructed the surveyor to obtain tenders for the wiring of Council houses in Brackenlea Lane.

Sunderland.—CABLES.—The Electricity Committee is to lay underground cables near Fawcett Street at £705, and at Pallion at £850.

Stirling.—REDUCED CHARGE.—The charge for private lighting by electricity has been reduced by Stirling Town Council by ½d. per kWh.

Stoke-on-Trent.—SUB-STATIONS.—The Electricity Committee recommends the erection of sub-stations at Broad Street, Hanley, and Whieldon Road, Fenton.

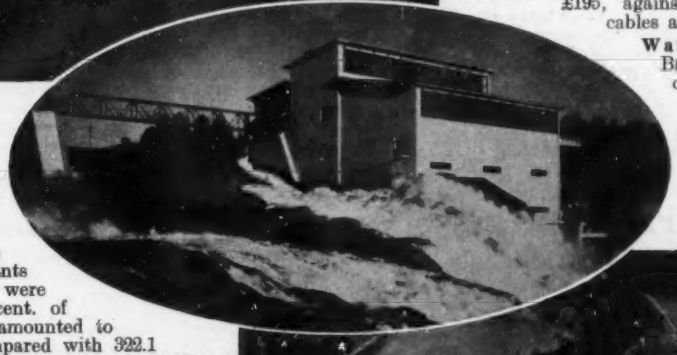
Swaffham.—RESULT OF CANVASS.—The East Anglian Electricity Co. has informed the Rural District Council that the result of a canvass at Necton and Holme Hale showed an annual income of only 8·7 per cent. on the capital cost, and it is unreasonable to expect it to give a supply at present.

Sweden.—HYDRO-ELECTRIC POWER.—The illustrations on this page shows three important hydro-electric power stations. Trollhättan, which is State controlled, is the largest plant in the country and is situated on the River Götaälv. It has a capacity of 190,000 h.p., the head being 105 ft. The Hammarforsen plant has a capacity of 30,000 h.p. and belongs to companies affiliated to the Swedish Pulp Co. All the stations of this concern are linked together by grid lines. The Alvkarleby plant, with a capacity of 100,000, is another State-controlled station. Sweden relies mostly upon water power for its electricity, and utilises one-sixth of the extensive sources of energy. The present machinery capacity is 1,900,000 h.p., while the annual output is nearly six million kWh. The southern half of the country, in which five-sixths of the population of Sweden live, contains a quarter of the available water power and electricity is transmitted *via* 220,000 V lines from Krangede to Stockholm, a distance of 300 miles. The preliminary estimate of the Government Waterfalls Department for 1935-36 forecasts a surplus of income over expenditure of 18.5 million kronor (£1,020,903 at par). This means an increase in the total revenue in comparison with the preceding year of 2.5 million kronor (£137,665 at par). The electrified State railways, and those in course of electrification, have a total length of 1,940 route miles. The total cost is estimated at £15,000,000, and the annual power consumption will be about 400,000,000 kWh, equivalent to 8 per cent. of the total present output of the country.

Throwleigh (Devon).—SUPPLY PLANNED.—Proposals by the West Devon Electric Supply Co., Ltd., for providing Throwleigh with electricity has been approved by the Okehampton Rural District Council. Mr. W. Pitts, mains engineer to the company, states that he has altered his plans according to a suggestion made by the South Devon Regional Planning Committee that there should be no overhead wires in the old parts of the village.

Ventnor (I.o.W.).—INQUIRY.—An inquiry was held recently into the application of the Isle of Wight Electric Light & Power Co., Ltd., for permission to erect overhead lines on the Ledgings Estate, Bonchurch. The application was opposed by the Rural District Council which claimed that local amenities would be affected. It was stated, on behalf of the company, that the cables were to supply 30 houses and that the scheme would cost £195, against £612 for underground cables and services.

Watford. — CONSUMERS TO BENEFIT.—The Town Council has announced a 5 per cent. rebate to consumers, including meter rental and hire charges for cookers, and other apparatus. Other substantial reductions have also been authorised.



Swedish hydro-electric stations: Above: Alvkarleby on the Dalälven (Aero Material A.-B). Centre: Hammarforsen. Below: Trollhättan (Oscar Bladh)

Wellington (Somerset).—EXTENSIONS.—The Wellington District Electricity Co., Ltd., proposes to extend mains at West Buckland, Bradford, Poole, Cheston, Ham, and Hockaller.

Willesden.—NORTH CIRCULAR ROAD LIGHTING.—The lighting of the recently completely section of the North Circular Road from Stonebridge to Ealing has now been completed, and consists of "Mercra" electric discharge lamps mounted on steel columns. These have been erected on one side of the road only, the intention being to erect the lamp columns on the other side when the road has been widened in accordance with plans. The length of roadway illuminated is approximately 1¼ miles. The whole of the work has been carried out by the staff of the Willesden Electricity Department.

Yeovil.—COUNCIL HOUSE SUPPLIES.—The Town Council has rejected an offer of the Wessex Electricity Co. to install, free of charge to the Council, four lighting points in each of the 129 Council houses on the Westfield site. Tenants are to be allowed to choose between electricity and gas.

Wemyss (Fife).—ELECTRICAL PLANT FOR MINE.—The Wemyss Coal Co., Ltd., East Wemyss, has a large scheme of reconstruction work on hand at several collieries. At the Victoria Pit, West Wemyss, reputed to be the oldest working colliery in Britain, electric winding engines are to be installed, and two electrically-driven turbine pumps are being erected at the pit bottom.

Whitburn.—DISSATISFACTION.—The Town Council is dissatisfied with the offer of the Scottish Midlands Electricity Supply, Ltd., in connection with the supply for the new housing scheme, and has decided to ask for a reduction in the company's terms, particularly with regard to the withdrawal of the condition regarding the exchange of cookers.

Traction

Australia.—PERTH TROLLEY BUSES.—Mr. J. A. Ellis, Commissioner of Railways in West Australia, reports that in the first year's operation on the Perth trolley bus route to September 30th last the earnings were £6,706; working expenses £5,464; interest £792; and depreciation £1,500, leaving a net loss of £1,050. The figures show that the system more than paid its working expenses and interest, but there was no provision for the depreciation on the vehicles.

Bradford.—TROLLEY-BUSES.—The Tramways Committee has recommended the purchase of fifteen trolley-buses for service on the Duckworth Lane route which is at present served by trams. An extension of the Duckworth depôt is also recommended so that it may accommodate the thirty vehicles which will then be plying on this route.

Portsmouth.—RECONSTRUCTION OF TRAM TRACK.—In connection with the Corporation's £206,100 Greetham Street development scheme it is proposed to reconstruct the tramway track at a cost of £5,500.

Newport.—TRAMS TO BE RETAINED.—The Town Council has decided to retain its tramways. It was reported that if the trams remained in service for five years there would be a direct relief to the ratepayers of £4,000 per annum, but if they were superseded by buses an increased rate burden of between £4,000 and £5,000 per annum would result.

South Shields.—TROLLEY-BUS FILM.—An English Electric film showing the working of trolley-buses in various towns and cities in England was shown recently to members of the South Shields Town Council. Among the towns included were London, Huddersfield, Southend and Hastings. According to the *Electric Railway, Bus and Tram Journal*, the film has been produced by the Electrical Development Association with a view to encouraging the use of these vehicles in this country.

Traffic Signals.—The Middlesex County Council is to provide traffic signals at Chiswick High Rd. (£2,250).

Communications

Germany.—TELEPHONE BROADCAST PROGRAMMES.—According to *The Times* the German Post Office has just completed tests in Berlin with a new system of broadcasting along wires. The results were satisfactory, and large-scale tests are now to be made in a provincial district. The system employed differs both from that used by wireless exchanges in Great Britain and from that of the Swiss telephone administration.

The method is to superimpose three programmes on wavelengths between 1,000 and 2,000 metres on the telephone cable circuits, and thus enable listeners, if they are telephone subscribers, to choose one of the programmes on an ordinary radio set, which is then connected to the telephone instrument.

The advantage of this system is the low cost of transmitters, and the fact that the telephone and radio set can be used at the same time. The listener can also switch on to an ordinary aerial, and use his set as usual if he chooses. The adoption of the new system is almost certain, at least in regions where reception is bad at present, provided that the large-scale tests prove as satisfactory as those in Berlin.

Glasgow.—POLICE RADIO EXPERIMENTS.—Attention is being devoted to communication between police forces in Scotland, and experiments at Glasgow are being carried a stage further by the erection of a transmitting station at Pinkston. The new station will serve Glasgow and other forces in the west of Scotland, and should the limited scheme prove successful it may be developed to include the whole of Scotland.

South Africa.—A LARGE TOTALISATOR.—Automatic Telephones (S.A.), Ltd., representing the Automatic Electric Co., Ltd., of Liverpool, have just completed at Johannesburg, for the African Greyhound Racing Association, what is said to be the largest greyhound racing totalisator in the world. The machine formed a feature of the second anniversary meeting of the Association, when it worked perfectly.

Parliamentary News

(BY OUR SPECIAL REPORTER)

ON December 20th the Electricity (Supply) Bill was considered on report.

Sir J. Nall moved an amendment to provide that any agreements which had already been entered into by the Board should not be extended beyond the original period for which they were made unless the Electricity Commissioners were satisfied by the Board in accordance with the terms of the sub-section.

Mr. Hore-Belisha said that the Clause enabled the Board to stand behind an authorised undertaker who wished to supply a special customer asking for exceptional quantities of electricity at a special price and under special conditions. They had opened to the review of the Commissioners such agreements in the future. There were difficulties about opening to review past agreements. He would be glad to accept the principle of the amendment. The amendment was agreed to.

On Clause 4 (Supply of electricity by the Central Electricity Board to railway companies) Sir Joseph Nall moved that notwithstanding anything in the section no electricity supplied thereunder to a railway company by the Central Electricity Board should within the area of supply of any authorised undertakers, be used without the consent of those undertakers otherwise than for the purposes of the company's railway undertaking.

Mr. Hore-Belisha said that if he accepted this amendment it would give to authorised undertakers a protection which they did not at present possess. There was really now a double safeguard. No supply of electricity for traction purposes could be used for other purposes except with the consent of the Minister of Transport. That protection had hitherto been considered sufficient, but the present amendment went even further and said that the consent of the authorised undertaker must be obtained as well. As he was anxious to carry out the undertakings he had given he would not oppose the amendment if the House desired to carry it. The amendment was agreed to.

On the motion of the third reading Mr. Hore-Belisha pointed out that the Bill had been greatly modified in its passage through the House. Under the first clause there was now to be a review of agreements, and under the second clause the agreements were to be reviewed when they came to the end of their period and before they could be renewed. The servants of railway companies who might be displaced from their generating stations as a result of the direct supply being taken from the Board were to be compensated, and authorised undertakers were to obtain a protection against the supplies which were obtained for the purposes of traction and the railway undertaking generally being used in competition when they might legitimately claim to have a monopoly of supply. He hoped that certain changes the Government had made in the Bill would allay misgivings.

In spite of some Conservative protests that the Bill was really "Socialist policy," it was read the third time.

Coal Consumption Figures

On December 18th Mr. West asked the Minister of Transport, what was the total consumption of coal for the years 1913 and 1933 in the gas and electrical industries, respectively.

Mr. Hore-Belisha said that the coal consumption at the electricity generating stations of authorised undertakers and railway and tramway authorities was 10.33 million tons in 1933, and 4.9 million tons in 1913. The amount of coal carbonised at gas works was 17.36 million tons in 1933 and 17.37 million tons in 1913.

A Gloucestershire Case

On December 19th Mr. Perkins asked the Minister of Transport whether he was aware that for over three years the question of supplying electricity to the town of Minchinhampton, Gloucestershire, had been under consideration; and whether there was any possibility of some immediate decision being taken.

Mr. Hore-Belisha said that the West Gloucestershire Power Company had decided to proceed with a further extension of its high-voltage system which, when completed, would bring the supply within a short distance of Minchinhampton, and had intimated its intention of canvassing that town to ascertain whether the demand was likely to warrant further capital expenditure on low-voltage mains in the locality. The Electricity Commissioners were in communication with the company as to the results of the canvass and were pressing the company for an early decision on the matter.

High-voltage Equipment

On December 20th Mr. Rhys Davies asked the Minister of Transport whether his attention had been called to the lack of control by local authorities over the erection or installation of high-voltage electrical devices; and whether he had yet considered what steps could be taken to remove this danger.

Mr. Hore-Belisha said that overhead high-voltage electric lines were subject to the Regulations made by the Electricity Commissioners for securing the safety of the public, but if the hon. member would let him know in what respects he considered danger arose, he would look further into the matter.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—SYDNEY.—N.S.W. Department of Road Transport. January 28th. Traffic control equipment for nineteen street intersections. (A.Y. 12796.)*

MELBOURNE.—Posts and Telegraphs Department. January 29th. Ringing and tone equipment (vibratory type) and delayed alarm control equipment. (A.Y. 12771.)*

February 19th. Magnets and automatic telephone hand-sets and accessories. (A.Y. 12829.)* Jumper and other insulated wire. (A.Y. 12831.)*

February 5th. Outside distributing wire. (A.Y. 12830.)*

Beckenham.—January 28th. U.D.C. L.p. paper-insulated cables. (See this issue.)

Bedford.—January 10th. Beds and Northants Joint Board for the Mentally Defective. Electric installation work at Bromham Colony. (December 14th.)

Belfast.—January 5th. Harbour Commissioners. 30-ton electrically operated gantry crane on the Albert quay. Particulars from T. N. Burke, superintendent of cranes; tenders to M. J. Watkins, general manager and secretary, Harbour Office.

Bexley.—January 26th. U.D.C. Street-lighting equipment. (December 21st.)

Birmingham.—January 3rd. Electric Supply Department. E.h.p. metal-clad sub-station switchgear, transformers and reactances, transformer oil and l.p. a.c. switchgear. (December 7th.)

January 15th. Corporation. Thirty lead plate batteries for electric vehicles. (December 21st.)

Brighton.—January 2nd. Electricity Department. V.i.r. cable for year ending December 31st, 1935. (December 21st.)

Buxton.—January 4th. Electricity Department. 6.6-kV 400-V 3-phase 50-cycle transformers. (January 21st.)

Chesterfield.—January 12th. One 250-kW two-bulb rectifier equipment. (December 21st.)

Cleethorpe.—January 25th. U.D.C. Electric lift and motor for electricity showrooms. Particulars from the U.D.C. engineer.

Coventry.—December 29th. Electricity Department. Extension to switchgear bay at Longford generating station. Specifications from Sandy Lane generating station; tenders to the chairman, Electricity Committee.

Egypt.—CAIRO.—January 12th. Ministry of Public Works. Twelve electrically driven centrifugal pumping units and accessories. (G.Y. 14573.)*

January 16th.—Two electrically driven centrifugal pumping units for Esna Barrage. (G.Y. 14572.)*

January 21st. Three portable d.c. generating sets with cables, projectors, lamps, &c. (A.Y. 12822.)*

Exeter.—January 5th. Devon C.C. Electrically operated swing bridge over canal. Particulars from the county surveyor (deposit £5 5s.).

Farnborough.—January 19th. U.D.C. Street lighting for approximately 4½ miles of main roads. (See this issue.)

Hastings.—January 31st. Electricity Department. Copper wire, &c., for the year ending March 31st, 1936. (See this issue.) Electrical materials for the year ending March 31st, 1936. (December 7th.)

Heston and Isleworth.—January 4th. Electricity Department. Enamelled slate d.c. feeder panels, complete with circuit-breakers. (See this issue.)

Ilford.—January 18th. Electricity Department. 500-kVA outdoor transformer. (See this issue.)

Irish Free State.—DUBLIN.—January 31st. Electricity Supply Board. One 20,000-kW turbo-alternator and exciter, complete with condensing and auxiliary plant. (December 14th.)

London.—H.M. OFFICE OF WORKS.—January 1st. Wiring for electric lighting, power and bells at the Imperial War Museum. (December 14th.)

CAMBERWELL.—January 14th. Borough Council. Twelve months' contracts for various items including the maintenance of electric lighting, heating and power installations, electric clocks, &c., and the supply of electric lamps. Forms of tender, &c., from borough engineer and surveyor, Town Hall.

ISLINGTON.—January 16th. Borough Council. Electrical and engineers' stores for one year commencing April 1st, 1935. (December 14th.)

POPLAR.—January 16th. Borough Council. D.c. three-wire switchboard. (December 21st.)

WANDSWORTH.—January 9th. Borough Council. Various items, including lamps. Particulars from the town clerk.

New Zealand.—CHRISTCHURCH.—Drainage Board. April 5th. Three electrically driven sewage pumping sets, with starters, pipes, valves, &c. (G.Y. 14505.)* Five panels of switchgear for supply to a pumping station. (A.Y. 12795.)*

WELLINGTON.—Posts and Telegraphs Department. February 13th. Power relays. (A.Y. 12780.)*

February 12th. Biasing springs, bridging coils, keys, jacks, &c. (A.Y. 12847.)*

February 14th. 15,000-ft. of switchboard cable. (A.Y. 12842.)*

February 21st. V.i.r. wire. (A.Y. 12843.)*

February 4th. Insulated and braided bronze wire. (A.Y. 12834.)*

February 26th. 5,100 galvanised earth rods. (A.Y. 12836.)*

February 28th. Switchboard cables. (A.Y. 12837.)*

February 25th. Enamelled copper wire. (A.Y. 12804.)*

February 20th. Insulated, impregnated and l.c. telephone cable. (A.Y. 12828.)*

February 21st. Flameproof jumper wire. (A.Y. 12832.)*

Public Works Department. February 19th. 50-kV outdoor switchgear, including steelwork, for Henderson sub-station. (A.Y. 12758.)*

March 5th. Seven 8,000-kVA transformers. (A.Y. 127577.)*

Porthcawl.—January 14th. U.D.C. Three sets of electrically driven centrifugal sewage pumps. Particulars from J. Taylor & Sons, engineers, Caxton House, Westminster, S.W.1.

Saltcoats (AYRSHIRE).—January 10th. Town Council. Electric lighting at new housing scheme. Schedules from H. Thomson & Sons, architect and surveyor, 60, Hamilton Street; tenders to joint town clerks.

Sheffield.—January 8th. Electricity Department. Transformers, switchgear and reactors. (December 21st.)

South Africa.—JOHANNESBURG.—January 29th. Electricity Supply Commission. Steam-raising plant, steam turbine-driven alternators, and three feed pumps and feed heaters and surge tanks. (G.Y. 14522.)*

City Council. January 17th. Electric cables. (A.Y. 12845.)* L.p. switchgear. (A.Y. 12839.)* H.p. switchgear. (A.Y. 12846.)*

February 5th. Nine traction sub-station equipments for railways. (A.Y. 12816.)*

PRETORIA.—Union Tender and Supplies Board. January 11th. 150 automatic patrol telephone hand-sets. (A.Y. 12814.)*

January 25th. Lead alloy sheathed p.i. cables. (A.Y. 12851.)*

January 18th. Government Supplies Board. Private branch telephone exchange switchboards and material. (A.Y. 12825.)*

Southend-on-Sea.—January 3rd. Electricity Department. Transformers. (December 14th.)

Stoke-on-Trent.—January 9th. Electricity Department. Battery repairs at Burslem sub-works. (See this issue.)

Tasmania.—HOBART.—Hydro-Electric Commission. January 7th. Metering equipment. (A.Y. 12774.)*

Uruguay.—MONTEVIDEO.—State Electricity Supply and Telephones Administration. February 4th. Porcelain insulators, fuses, &c. (A.Y. 12813.)*

March 4th. 45,000 aerial fuses and 65,000 fuse plugs. (A.Y. 12815.)*

Witney.—January 2nd. Electricity Department. 11-kV switchgear, indoor, oil-immersed, three-phase transformers, and l.p. distribution fuseboards. (November 30th.)

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Belford.—Parish Council. Accepted. Electric street lighting.—F. Reid, Ferens & Co.

Glasgow.—Streets and Building Committee. Recommended. Automatic traffic control signals in the centre of the city (£31,610).—Automatic Electric Co., Ltd.

Public Assistance Committee. Accepted. Electrical fittings for a period of six months.—J. T. Cartwright & Sons, Ltd.

Government Contracts.—The following contracts were placed by the various Government Departments during November:—

ADMIRALTY.

Dry batteries.—Siemens Bros.

Fuse boards and junction boxes.—Wm. McGeoch & Co.; Small Electric Motors; Whipp & Bourne.

Power boards.—Ferguson, Pailin; Wm. McGeoch & Co.; Small Electric Motors; Whipp & Bourne.

W.t. coils.—R.I., Ltd.

Condensers.—Dubilier Condenser Co. (1925); Muirhead & Co.; Telegraph Condenser Co.

Electric gantry crane.—Cowans, Sheldon & Co. Sub-contractors: Mawdsley for motors; Allen West & Co. for controllers.

Electric lighting fittings.—G.E.C.

Steam driven generators.—W. H. Allen, Sons & Co.

Motors for lathes.—Lancashire Dynamo & Crypto.

Control gear for lathes.—Brookhirst Switchgear.

Mixing and mincing machines.—Hobart Manufacturing Co. Sub-contractors for electrical equipment: G.E.C.

Motor-driven surfacing and boring machine.—G. Richards & Co. Sub-contractors: Lancashire Dynamo & Crypto for motors; Veritys & H. W. Kearns & Co. for controller; Laurence, Scott & Electromotors for motors and control gear.

Pneumatic gear.—Sturtevant Engineering Co. Sub-contractors: Mawdsleys for motors; E. N. Bray for starters.

Searchlight projectors.—Clarke, Chapman & Co.; Laurence, Scott & Electromotors.

Signalling projectors.—Met.-Vick. Elecl. Co. Sub-contractors: Pilkington Bros.; Clarke, Chapman & Co.; Chance Bros. & Co.

Telemotor pumps.—Vickers-Armstrongs. Sub-contractors: Laurence, Scott & Electromotors for motors; E. N. Bray for starters.

Switches.—Ferguson, Pailin; Walters Electl. Mfg. Co.; Veritys; Wm. McGeoch & Co.

Transformers.—Foster Engineering Co.

W.t. transmitters.—H. W. Sullivan; Marconi's.

Radio apparatus.—R.I., Ltd.; H. W. Sullivan; A. Graham & Co.; Plessey Co.; Marconi's.

WAR OFFICE.

Conduits and fittings.—Barton & Sons (1930); Walsall Conduits.

Generating sets and spares.—Ruston & Hornsby.

Electric meters.—Ferranti.

Switchgear spares.—Ferguson, Pailin.

AIR MINISTRY.

Accumulators.—Oldham & Son; Peto & Radford.

Beacon.—G.E.C.

Conduit fittings.—Walsall Conduits.
Generating set.—W. H. Allen & Co.; Belliss & Morcom.
Mobile wireless station.—Standard Telephones.
Receivers.—Marconi's.
Valves.—Ediswan.

POST OFFICE.

Telephonic apparatus.—Thomas De La Rue & Co.; Ericsson Telephones; G.E.C.; Gent & Co.; Phœnix Telephone & Electric Works; Plessey Co.; Siemens Bros.; Standard Telephones.
Cable.—Connollys (Blackley); Enfield Cable Works; W. T. Glover & Co.
Parts of secondary cells.—Britannia Batteries.
Loading coils.—G.E.C.; Standard Telephones.
Conduit.—Falk, Stadelmann & Co.; Longmore Bros.
Leclanché depolarising elements.—B.I. Cables; Ferguson Battery Co.; Fuller Accumulator Co. (1926); G.E.C.; Hellesens; I.R.G.P. & Telegraph Works; Siemens Bros.
Electric lighting fittings.—Hailwood & Ackroyd.
Wire.—B.I. Cables; Dorman, Long & Co.
Armoured cable work.—Lincoln-Spilsbury-Skegness.—G. Wimpey & Co. Gloucester-Oxford.—W. Connolly & Co.
Cabling.—Gloucester-Oxford, Southampton-Bournemouth.—Pirelli-General Cable Works. Southampton: Cardiff-Port Talbot-Swansea.—United Telephone Cables.
Electric lifts.—W. Wadsworth & Sons; Waygood-Otis.
Electric lighting.—Kershaws (Electrical Engineers).
Telephone exchange equipment.—Paddington (London).—Automatic Electric Co. Sub-contractors: Alton Battery Co. for batteries; Electric Construction Co. for motor-generators and ringing machines. London Wall, Metropolitan, National and Mansion House (London).—Automatic Electric Co. Wanstead (London); Dalkeith.—Ericsson Telephones. Waxlow, Ruislip (London); Knowle; Lossiemouth.—G.E.C. Feltham (London).—Siemens Bros. Sub-contractors: Hart Accumulator Co. for batteries; Electric Construction Co. for motor-generators. Leith.—Siemens Bros. Sub-contractors: Hart Accumulator Co. for batteries; Electric Construction Co. for motor-generators and ringing machines. Chippenham.—Standard Telephones. Sub-contractors: Tudor Accumulator Co. for batteries; Electric Construction Co. for motor-generators. Dunston, Enterprise (London); Bentley; Balby; Doncaster; Cantley; Little Chalfont; London Trunk and Toll.—Standard Telephones. Erith (London).—Standard Telephones. Sub-contractors: Hart Accumulator Co. for batteries; Electric Construction Co. for motor-generators; W. Jones & Co. for ringing machines.
Telephonic repeater equipment.—Birmingham, Tavistock, Taunton.—G.E.C.
Voice-frequency telegraph equipment.—Manchester, Nottingham, Barrow-in-Furness.—Standard Telephones.

H.M. OFFICE OF WORKS.

Electric goods lift.—H.M.S.O., Harrow.—Newbury & Thomas.

CROWN AGENTS FOR THE COLONIES.

Copper wire.—Shropshire Iron Co.; R. H. Symonds.
Meter spares, &c.—W. & S. Tylors.
P.b. poles.—Callender's Cable & Construction Co.
Signal materials.—Westinghouse Brake & Saxby Signal Co.
Superheater elements.—Superheater Co.
Telephones, &c.—G.E.C.
Telephone cable, &c.—Callender's Cable & Construction Co.; Standard Telephones; Henley's.
Test instruments for boiler plant.—Allen West & Co.
Wireless apparatus.—Standard Telephones; Radio Developments.

London.—HAMMERSMITH.—Electricity Committee. Three 250-kW transformers for a supply to the White City (£656).—British Electric Transformer Co., Ltd. Repairing and overhauling of of existing storage battery (£478).—Premier Accumulator Co.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended. Copper wire.—British Insulated Cables (S.A.), Ltd. (£469); Wolstenholme, Ltd (£902) Ironclad service cut-outs.—Siemens Bros. & Co. (British), Ltd. (£329); British General Electric Co., Ltd. (£153). Meters.—A. Vaux & Co., Ltd. Fibre conduits (£283).—Davis & Soper, Ltd. Battery-charging unit (£108).—C. E. Scott (Pty), Ltd. Overhead line material.—Guest Sykes, Ltd. (£396); W. D. Hearn & Co. (£135); British Insulated Cables (S.A.), Ltd. (£1,889); H. Davies & Co., Ltd. (£17); British General Electric Co., Ltd. (£180); South African General Electric Co., Ltd. (£136). Transformers.—British General Electric Co., Ltd. (£1,049); W. D. Hearn & Co. (£217); P. Gregson, Urquhart & Co. (£293); C. A. Parsons & Co., Ltd. (£4,771). Two 12,500-kVA transformers (£5,894).—Bruce Peebles & Co., Ltd. Protective equipment for transformer and switchboard (£4,489).—A. Reyrolle & Co., Ltd.

Forthcoming Events

Royal Institution.—Saturday, December 29th, Tuesday, Thursday and Saturday, January 1st, 3rd and 5th. Institution, London. Juvenile lectures on "Electricity," by Prof. W. L. Bragg.

Institution of Electrical Engineers (*Wireless Section*).—Wednesday, January 2nd. Institution, London. 6 p.m. "A "Magneto-Striction Echo Depth Recorder." Messrs. A. B. Wood, F. D. Smith and J. A. McGeachy. (*Meter and Instrument Section*).—Friday, January 4th. Institution, London. 7 p.m. "The Theoretical and Practical Sensitivities of Gas-Focused Cathode-Ray Oscillographs." Prof. J. T. McGregor-Morris and Mr. J. H. Henley; and "A Cathode-Ray Oscillograph Equipment Embodying a H.V. Gasfilled, Sealed-Glass Oscillograph Tube." Prof. S. Parker Smith, Dr. Ing. C. E. Szegho and Mr. E. Bradshaw.

Rugby Engineering Society.—Wednesday, January 2nd. B.T.H. Research Laboratory, Rugby. "Refrigeration." Mr. K. J. R. Cocke.

Association of Mining Electrical Engineers (*Kent Sub-Branch*).—Saturday, January 5th. Technical Institute, Dover. 6.30 p.m. "Low Temperature Carbonisation of Coal." Mr. Brentnall. (*West Wales Branch*).—Saturday, January 5th. Y.M.C.A., Swansea. "Flame-Proof Enclosures." Mr. G. M. Harvey.

Notes

The E.A.W. Helps the E.I.B.A.

The Electrical Association for Women, helping to raise funds for the Electrical Industries Benevolent Association, has devoted the proceeds from the E.A.W. tenth birthday cake, which amounted to £11 1s. 6d., to this cause, the winners of the top and bottom layers of the cake being Mrs. Ledbetter and Mrs. Empon. Again this year demonstrators from all parts of the country who hold the E.A.W. diploma are co-operating with the Association by making cakes for competition, to raise money for the same object.

Electric Locks in Belgium

Work has recently been completed on the construction of a large lock at Petit-Lanaye to connect the Maastricht and Albert canals, between which there is a difference of water level of no less than 26¼ ft. The lock, which comprises two large basins, is entirely electrically operated. The installation was carried out by the Société des Ateliers de Constructions Electriques de Charleroi and includes eighteen electric motors, together with the necessary control gear and a 200 kVA transforming station.

Testing Wire Ropes Magnetically

An account of an electro-maguetic method of testing for mechanical flaws in colliery winding ropes appeared in the December, 1933, issue of *Quality*, the Sheffield Chamber of Commerce journal. In the November, 1934, issue Dr. T. F. Wall shows that the only methods which have yielded results that show in a practicable and unmistakable fashion the onset of work-hardening are the magnetic methods now being developed in the Electrical Engineering Department of Sheffield Universty. Two distinct magnetic methods have been devised, each of which has its own special field of application. One comprises a ballistic test, the essential feature of which is the observation of the increase of magnetic permeability when a wire is loaded *after* it has been placed in a magnetic field of suitable strength. This method is, in fact, an examination of the combined effect of the application in the proper sequence of a mechanical force and a magnetic force. The second type of test is especially appropriate for lengths of wire which are greater than about 100 feet. In essence, this test consists in starting a pulse of stress at one end of the wire and observing by electro-magnetic means the rate at which the pulse travels along the wire and also the rate at which it decays as it travels. The rate of travel of the pulse is a measure of the value of Young's modulus and this quantity is of itself an indication of the state of work-hardening. An example of another application is the examination of the effects of heat treatment on wires and actual test data show that the tests provide means for observations of this kind from an entirely new angle. The quality of welded joints and seams may be most satisfactorily tested by electro-magnetic means and at least one type of an apparatus for this purpose is now available as a commercial article.

Research into the Electro-deposition of Metals

An appeal to industry for co-operation in maintaining research into the electro-deposition of metals explains that hitherto a committee appointed by the Department of Scientific and Industrial Research has directed the progress of this work, which has been carried out at the Research Department, Woolwich, the University of Sheffield, and the Royal Aircraft Establishment (Farnborough) during the past eight years. The work includes electro-deposition of nickel and chromium, the protection from corrosion of aluminium and its alloys by the electro-deposition of zinc, cadmium, &c., and fundamental questions, such as the occurrence of stress in deposits and the mechanism of adhesion. The cost of this work has been considerable and has so far been borne almost exclusively by the National Exchequer. The Department now takes the view that research of this kind, carried out for the benefit of industry, should be maintained by the branches of industry concerned, and consequently the work can continue only if it is adequately supported by industry. It is proposed that the work shall be taken over entirely by the British Non-Ferrous Metals Research Association. In this way Government support of the research would not cease, but would be dependent on the funds forthcoming from industry. The scheme in view has the full approval of the Department of Scientific and Industrial Research. The minimum expenditure necessary is £1,000 per annum, and the Association has made arrangements whereby the firms who subscribe shall have preferential access to the results as they become available, together with other privileges of membership. The secretary, British Non-Ferrous Metals Research Association, Regnart Buildings, Euston Street, London, N.W.1, will provide further particulars.

Appointments Vacant

General manager and engineer for Sheffield City Electricity Department (salary £1,500 per annum).

Chief assistant to general manager and traffic superintendent for the Hull Corporation Transport Department. (See our classified advertisements.)

Makers' Names Wanted

BARDISK bell indicator.

Our Personal Column

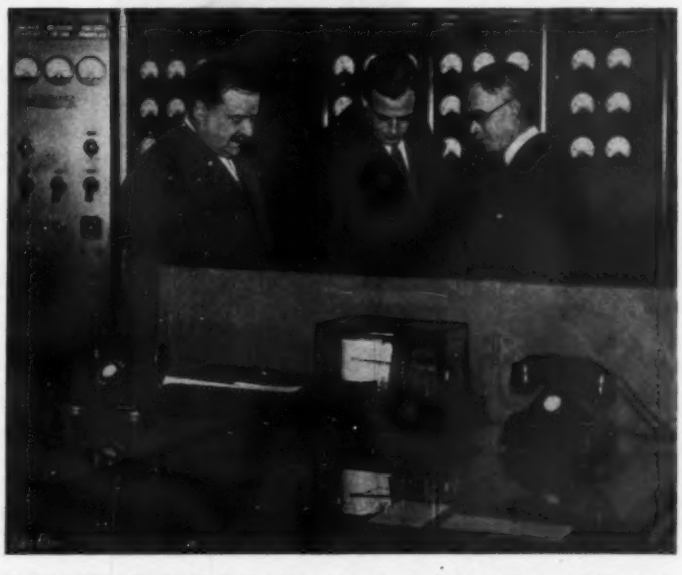
Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. A. Eaton, assistant tramways manager, and **Mr. L. Ralston,** the municipal garage superintendent, to the Johannesburg City Council are retiring from those positions on December 31st. Mr. L. M. Barry the manager of the tramways department has been requested to report on the reorganisation of the system.

Mr. A. J. Bousfield, A.M.I.E.E., who has acted as clerk of works during the construction of the new power station at Dagenham for the Ford Motor Co., has been appointed power house superintendent under **Mr. J. H. Boyd,** M.I.A.E., the chief engineer. The power station at which the Duke of Kent recently started up the high-pressure turbo-alternator, is now approaching completion, and the following additional appointments have been made:—Charge engineers: Messrs. J. Mullen, A. Forgan, J. J. Young and G. E. Walker. Steam engineers: Messrs. F. Willis, J. Ledingham, J. E. Kedzlie, and W. Dickie. Control room attendants: Messrs. H. Barnard, A. Hollis, D. M. McKensie, and E. H. Adamson. The accompanying illustration shows Mr. Boyd and Mr. Bousfield with the Duke of Kent on the occasion of the switching-in of the 30,000 kW 1,250 lb. per sq. in. turbo-alternator.

On Friday last **Mr. Martin Insull,** brother of Mr. Samuel Insull, was acquitted at Chicago on the charge of embezzling funds of the Middle West Utility Co. The jury was in conference for between six and seven hours. A second embezzlement charge against Mr. Martin Insull will be heard on January 15th.

Mr. S. K. Watson is leaving Messrs. Johnson & Phillips, Ltd., to join Mr. C. H. Hayward, M.I.Mech.E., who looks after the interests of several British electrical and mechanical engineering companies in the British West Indies and Central America. He sails about the end of January and his headquarters will be at Port-of-Spain, Trinidad, B.W.I.



Left to right: Mr. J. H. Boyd (chief engineer), the Duke of Kent, and Mr. A. J. Bousfield (power house superintendent) on the occasion of the switching-in of the 30,000 kW set at the Ford power station

A number of past and present employés and staff of the Sunderland Corporation Electricity Undertaking assembled at the Hylton Road Generating Works on December 14th, to take leave of **Mr. A. S. Blackman,** who has occupied the position of general manager and borough electrical engineer for the past twenty-eight years. The heads of the departments and two ex-employés spoke of Mr. Blackman's long association with the work of the electricity undertaking and its development since 1907. Mr. Adam Carr, who has seen over thirty-five years' service, handed Mr. Blackman a pair of prismatic binoculars, and Miss R. Richardson, a gold wristlet watch for Mrs. Blackman. Mr. Blackman replied and thanked everybody for their loyal help in the past.

Mr. F. C. Orchard, A.M.I.E.E., the author of the article on "Sub-station Maintenance" which appears on page 887, joined the Birmingham Corporation Electric Supply Department in 1923 as assistant to the Eastern District mains engineer. In 1925 he was successful in the I.E.E. examination, and was in consequence transferred to the Sub-station Department as assistant in charge of maintenance of the automatic rotary convertor and mercury-arc rectifier sub-stations. Two years later he was promoted to take charge of the construction of the automatic rotary and rectifier sub-stations, and subsequently was appointed to the special frequency-change staff to take charge under the frequency-change engineer of the change-over of all the Departments sub-stations from 25 to 50 cycles.

Mr. F. C. Orchard

The presentation to **Mr. R. P. Sloan** to which we referred in our issue of December 21st, p. 880, expressing the admiration and esteem of the employés of the North Eastern Electric Supply Co., of which company he will continue to be chairman though retiring from the managing directorship, was in two parts. One part, already reported, was presented by the Teesside staff and employés. The other was handed over to him on December 18th at a meeting of 600 employés in Newcastle-on-Tyne. Mr. H. A. Couves, the general manager and director was in the chair and he paid warm tribute to Mr. Sloan's leadership since he joined the company as its manager in 1903. Mr. A. G. Shearer, the operating superintendent in the company's northern area made the presentation, which consisted of a silver inkstand in the form of a model of one of the 50,000-kW turbo-alternators at the new Dunston power station. The model is made exactly to scale. Mr. Shearer extended to Mr. and Mrs. Sloan best wishes for years to come. Mr. Sloan, in responding, said that he believed in men retiring too early rather than too late. While it was a great wrench for him to give up the chief executive duties of the company, he felt that if he hung on for another five years the man who succeeded him and the men who assisted him would also be five years older and he was a believer in new blood being introduced into big business. Mr. Sloan is going to reside in Hampshire after the New Year. He is, as our readers are aware, a director of a number of important electric power and other companies.

At the request of **Mr. C. J. Spencer,** the Johannesburg City Council has sanctioned a visit to England by Professor Frankel, of the Witwatersrand University, and Mr. J. R. More, ex-general manager of the railways, for the purpose of consulting with Mr. Spencer on the municipal power station and workshops. Mr. Spencer was chairman of the recent commission of inquiry into the city transport system, and Professor Frankel and Mr. More were the two local members. Before Mr. Spencer returned to England the report on the transport system was handed in, and most of its recommendations have already been acted upon.

Mr. J. S. Ross, A.M.Inst.T., who has been appointed rolling stock and works engineer to the Liverpool Corporation Transport Department, has been rolling stock engineer with the Edinburgh Corporation Transport Department since 1929, having joined the engineering staff in 1920. He takes up his new duties in Liverpool early in January, and will be missed in Edinburgh, where he has always taken a keen interest in the social activities as well as the engineering work of the Department.

Mr. J. S. Ross

Mons. Ernest Mercia, president of the International Conference of Large High-Tension Distribution Systems, has been appointed a Commander of the French Legion of Honour.

Mr. F. M. Saddington, formerly Manchester area manager for Murphy Radio, Ltd., has been appointed sales director of Messrs. H. Clarke and Co. (Manchester), Ltd.

Mr. A. H. Todd, the engineer and manager of the Clitheroe electricity undertaking, has been responsible for the rural electrification scheme which has recently been completed, and details of which appear on page 906. He went to Clitheroe in December, 1930, having previously held appointments with the Accrington Corporation and the English Electric Co., Ltd.

Mr. A. H. Todd

Mr. G. W. Molle is sailing to-day (Friday) to take up an appointment with Messrs. Walker, Sons & Co., Ltd., engineers, of Colombo. His address will be c/o Hong Kong and Shanghai Banking Corporation, Colombo, Ceylon. Mr. Molle asks manufacturers to keep him advised of new developments. He retains his interest in the firm of Messrs. Seabrook & Partners.

Obituary

Mr. G. H. Sankey.—The death occurred on December 19th at the age of sixty-seven of Mr. George Herbert Sankey, managing director of Messrs. Joseph Sankey & Sons, and a director of Messrs. John Lysaght, Ltd. He commenced his career with Messrs. Joseph Sankey & Sons, sheet metal rollers and stampers, Bilston, his father, Mr. Joseph Sankey, being the founder of the business. He succeeded his brother, Mr. G. Sankey, as managing director in 1913. He leaves four sons, all of whom are in the business of Messrs Joseph Sankey & Sons, two of them, Lt.-Col. H. B. Sankey and Mr. G. R. Sankey, being directors.

Mr. C. Newton Russell.—We regret to learn of the death of Mr. Charles Newton Russell, A.M.Inst.C.E., M.I.E.E., which occurred on December 22nd at Charta Cottage, Wraysbury, at the age of seventy-six years. Mr. Newton Russell retired from the service of the Shoreditch Borough Council in October, 1925, after being its electrical engineer for twenty-nine years. It was during his early occupation of that post that the, at that time outstanding efforts were made to utilise town's refuse for steam-raising in connection with the undertaking. He was succeeded on his retirement nine years ago by Mr. William Weekes, who had been his chief assistant for many years. An account of Mr. Russell's career from his apprenticeship at Stockton-on-Tees and the period spent as a student at the Hanover Square School of Telegraphy down to the date of his retirement, was given in the ELECTRICAL REVIEW of October 30th, 1925. The funeral took place at Woking Crematorium on Monday.

Mr. Richard Henry Scotson, borough electrical engineer at Middlesbrough for the past nineteen years, died suddenly on December 18, at the age of fifty-five, following a heart attack. He had been unwell for a few days but had carried out his duties as usual. Mr. Scotson succeeded Mr. H. M. Taylor as borough electrical engineer in 1915 and was chairman this year of the North-East Coast branch of the Electrical Development Association. One of his achievements for which he was warmly commended was the securing of a bulk supply of electricity at a low price from the North-Eastern Electric Supply Co., Ltd. The interment took place at Middlesbrough on Saturday last.

Dr. J. C. Bowie.—The death occurred suddenly last Saturday at Cardiff, of Dr. John Cunningham Bowie, who many years ago turned his attention to the study of electrical high-frequency treatment of disease. He wrote many important treatises on this and kindred subjects. He was seventy-two years of age.

Mons. E. Broin.—The death is reported from Paris, at the age of sixty-nine, of M. Emile Broin, for many years Director of the French Department of Telegraphs and Radio-communications.

Will.—Sir Arthur Schuster, the celebrated scientist, left £284,513 with net personalty, £269,862.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Reed & Reed, Ltd.—Private company. Registered December 15th. Capital, £1,000 in 800 6 per cent. non-cumulative preferred ordinary shares of £1 each and 4,000 deferred shares of 1s. each. Objects: To carry on the business of electrical, radio and sound, consulting and mechanical engineers, &c. The directors are A. H. Reed, 62, Coniston Road, Bromley, Kent, and L. W. Reed, 73, Brent Street, Hendon. Registered office: 104/108, Oxford Street, W.1.

Northern Radio Contracts, Ltd.—Private company. Registered December 17th. Capital, £2,000 in 1,000 6 per cent. cumulative preference and 1,000 ordinary shares of £1. Objects: To carry on the business of manufacturers of and dealers in wireless receiving sets, aerials, cabinets, dials, &c. The directors are: H. R. Somper, 70, Sutton Court Road, Chiswick, W.3, and G. R. C. Wren, "Resthaven," Tilford Road, Farnham, Surrey. Registered office: 63, Queen Victoria Street, E.C.4.

Carmarthen Radio Relay, Ltd.—Private company. Registered December 18th. Capital, £500 in £1 shares. (100 7 per cent. redeemable cumulative preference and 400 ordinary). Objects: To acquire the business of relaying wireless broadcast programmes carried on by R. J. Eggleston and Kathleen Eggleston, at Carmarthen and district. The directors are: R. J. Eggleston, 5, St. Mary Street, Carmarthen, and Mrs. K. Eggleston, 40, John Street, Porthcawl. Solicitor: W. J. Wallis-Jones, Carmarthen.

Taylor & Wise, Ltd.—Private company. Registered December 18th. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrical and radio engineer and battery service agent carried on by Vernon Wise as "Taylor & Wise," at 298, Sandycombe Road, Kew Gardens, Surrey. The first directors are: V. Wise (permanent), 298, Sandycombe Road, Kew Gardens, Surrey, and J. W. Wise, 11, Wellington Avenue, North Cheam, Surrey. Registered office: 298, Sandycombe Road, Kew Gardens, Surrey.

E.C.D., Ltd.—Private company. Registered December 18th. Capital, £30,000 in £1 shares. Objects: To acquire the whole or any part of the undertaking, business and assets of the Electro Chemical Development Syndicate, Ltd.; to develop electrolytic apparatus for the production of chemicals, &c. The subscribers are: G. P. Chamberlain, "Clarisma," Winchelsea Gardens, Worthing, and C. W. Bald, Willow Gates, Wallace Avenue, Worthing, company director. C. W. Bald signs documents as director and secretary. Registered office: Town Mills, Tonbridge, Kent.

Radiosetz, Ltd.—Private company. Registered November 29th. Capital, £5,000 in £1 shares (500 founders' and 4,500 ordinary). Objects: To acquire the business of a radio manufacturer and wholesale and retail radio merchant and dealer carried on by E. N. K. Lemon at New Laithes House, Horsforth, Yorks, as "Radiosetz." The permanent directors are: E. N. K. Lemon, New Laithes House, Horsforth, Yorks, and L. Shaw, "The Bays," Knutsford, Ches. Registered office: Martins Bank Chambers, Park Row, Leeds.

Horton, Smith & Co., Ltd.—Private company. Registered December 17th. Capital, £500 in £1 shares. Objects: To acquire the business of electrical engineers and contractors carried on by H. M. Smith, B. R. Muir, and H. M. Horton as "Horton Smith & Co.," at 57, Uxbridge Road, Ealing, W.5. The directors are: H. M. Smith, 8, Amherst Avenue, W.13, and two others. Solicitors: R. Hamilton Twyford & Co., 4, Regent Street, S.W.1.

Eltham Radio Service, Ltd.—Private company. Registered December 14th. Capital, £500 in £1 shares. Objects: To carry on the business of wholesale and retail manufacturers, importers, exporters and repairers of and dealers in radio-telegraph, television, and telephone apparatus, &c. The permanent directors are: A. Dunton and Mrs. C. Dunton, both of Paddock Way, Holbrook Lane, Chislehurst. Registered office: 71, High Street, Eltham, S.E.9.

Bristol Rental Corporation, Ltd.—Private company. Registered December 15th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of, and wholesale and retail dealers in, electrical and mechanical apparatus, accessories and components, including radio sets, gramophones, &c. The first directors are: R. A. Bush (chairman), Brynteg, Brecon Road, Westbury-on-Trym, Bristol, and two others. Registered office: 72, West Street, St. Philips, Bristol.

Hillside Radio Co., Ltd.—Private company. Registered December 1st. Capital, £5,000 in £1 shares (3,000 ordinary and 2,000 preference). Objects: To carry on the business of manufacturers of and dealers in wireless and television sets and accessories, radiograms, gramophones, &c. The first director is F. F. Munns, Hillside, South Hill Avenue, South Harrow.

Park Radio Relay (Gt. Harwood), Ltd.—Private company. Registered December 5th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers and installers of and dealers in wireless, electrical and mechanical goods, relayers of wireless reception, &c. The directors are: S. Park and Mrs. Gertrude O. Park, both of Cliffe Pumping Station, Great Harwood, Lancs. Registered office: 8, Poplar Avenue, Great Harwood, Lancs.

B. & B. Scott, Ltd.—Private company. Registered November 16th. Capital, £300 in £1 shares. Objects: To carry on the business of electrical, mechanical, domestic and radio engineers and contractors, &c. The directors are: Queenie B. Scott, 37, High Street, Ruislip, Middlesex, and two others. Registered office: 37, High Street, Ruislip, Middlesex.

Returns of Electrical Companies

Durham County Relay Service, Ltd.—Debenture, dated November 14th, 1934, to secure £200, charged on the company's property, present and future, including uncalled capital. Holder: J. F. Powell, 93, Hayes Road, Clacton-on-Sea.

Ingleton Electric Lighting & Power Co., Ltd.—F. Harrison, Piece Hall Yard, Bradford, ceased to act as receiver and manager on June 13th, 1934. (Notice filed November 29th, 1934.)

Earl Manufacturing Co., Ltd.—C. H. I. Chown, 23, Bush Lane, Cannon Street, E.C.4, was appointed receiver and manager by Order of Court dated November 23rd, 1934.

Booth & Bomford, Ltd.—Debenture, charged on 99, Port Street, Evesham, Worcs, and the company's undertaking and other property, present and future, including uncalled capital, dated November 10th, 1934, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

British Relay Wireless, Ltd.—Capital, £5,000 in £1 shares. Return dated October 16th, 1934. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Thomas A. Rose & Son, Ltd.—Satisfaction to the extent of £800 on August 31st, 1933, of debentures authorised April 6th, 1933, and registered April 25th and May 2nd, 1933, securing £1,000. (Notice filed December 1st, 1934.)

Alarcal, Ltd.—The nominal capital has been increased by the addition of £16,000 in £1 shares beyond the registered capital of £4,000.

Vul-K-Loc, Ltd.—The nominal capital has been increased by the addition of £1,000 beyond the registered capital of £1,000. The additional capital is divided into 1,000 6 per cent. cumulative participating preference (not redeemable) shares of £1 each.

Debenture, dated November 21st, 1934, to secure £200, charged on the company's property, present and future, including uncalled capital. Holder: R. W. Faulkner, 38, Garston Old Road, Liverpool.

Lane & Ryder, Ltd.—Capital, £1,000 in £1 shares. Return dated November 19th, 1934. All shares taken up. £100 paid. £900 considered as paid. Mortgages and charges, nil.

H. A. Lee, Ltd.—Capital, £1,500 in £1 shares. Return dated September 28th, 1934. 1,350 shares taken up. £550 paid. £800 considered as paid. Mortgages and charges, nil.

Dynameg, Ltd.—H. J. Smith, 48, Castle Street, Liverpool, ceased to act as receiver and manager on November 26th, 1934.

H. Norman Kirk, Ltd.—Debenture charged on properties in Swansea and the company's undertaking and other property, present and future, including uncalled capital, dated November 20th, 1934, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd., not exceeding £10,000.

Brightglow, Ltd.—Debenture dated November 17th, 1934, to secure £470, charged on the company's property, present and future, including uncalled capital. Holder: R. J. Beak, Priors Court Farm, Newbury, Berks.

Wilkinson, Bentley & Co., Ltd.—Capital, £3,000 in £1 shares. Return dated October 24th, 1934. 1,850 shares taken up. £1,850 paid. Mortgages and charges. nil.

Van Raden & Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 31st, 1934. 6,754 shares taken up. £4,654 paid. £2,100 considered as paid. Mortgages and charges, nil.

Metropolitan Rediffusion Services, Ltd.—Satisfaction to the extent of £1,200, together with premium of 2½ per cent. on November 30th, 1934, of series of debentures, authorised by resolution dated September 13th, 1934, and registered September 20th, 1934. (According to the register of mortgages, the series of debentures registered September 20th, 1934, originally secured £1,200, and premium of 2½ per cent.)

Nottingham Rediffusion Service, Ltd.—Debenture dated December 3rd, 1934, to secure £5,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. Hoare & Co., 37, Fleet Street, E.C.4.

British Crystal Lamp Co., Ltd.—The nominal capital has been increased by the addition of £100 beyond the registered capital of £100. The additional capital is divided into 100 6½ per cent. preference shares of £1.

Westmorland and District Electricity Supply Co., Ltd.—Debenture dated December 7th, 1934, to secure £150,000 and further advances, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Johnson & Phillips, Ltd., Columbia House, Aldwych, W.C.2.

A. E. Morrison & Sons, Ltd.—The nominal capital has been increased by the addition of £10,000 beyond the registered capital of £10,000. The additional capital is divided into 7,000 preference and 3,000 ordinary shares of £1 each.

Electric Development & Securities Trust, Ltd.—The nominal capital has been increased by the addition of £100,000 beyond the registered capital of £750,000. The additional capital is divided into 100,000 ordinary shares of £1 each. The additional shares are to be issued to the General Electric Co., Ltd.

Westminster Tool & Electric Co., Ltd.—Satisfaction in full on December 10th, 1934, of debenture dated June 22nd, 1923, and registered June 26th, 1923, securing £4,500.

Debenture, dated December 8th, 1934, to secure £4,500, charged on the company's undertaking and property present and future, including uncalled capital (subject as to freehold property to first mortgage thereon, dated March 9th, 1923). Holder: W. T. Lovering, 22, Braemore Road, Hove.

Concordia Electric Safety Lamp Co., Ltd.—Issue on November 29th, 1934, of £1,500 debentures, part of a series already registered.

R.A.P., Ltd.—Issue on December 6th, 1934, of £300 debentures, part of a series already registered.

City Notes

R. A. Lister & Co., Ltd.—Presiding at the annual meeting on December 20th, Mr. C. P. Lister (chairman and managing director) said the company's turnover during the year under review showed an increase of 38 per cent. over the figure for the previous year, while the profit of £80,869 compared favourably with the figure of £60,774 for 1932-33. Their trading at home had been fully maintained, particularly in Diesel engines, which were used for an ever-increasing variety of purposes in the marine, electrical, agricultural and industrial fields. They had experienced a steady and increasing demand for their electric light and power plants. In the Empire markets, the benefits accruing from the Ottawa Agreements had made themselves tangibly felt. With regard to the overseas markets, other than those of the Empire, in company with all other exporting producers they were experiencing difficulties created by quotas, high tariffs and currency restrictions, but they had been able to retain a large measure of business in these markets in spite of these difficulties. In planning their sales and production programme for the year ahead, they had decided upon more intensive representation not only at home, but also in the Empire and overseas markets.

Benham & Sons, Ltd.—Presiding at the annual meeting held on December 13th, Mr. S. J. Benham (managing director), who presided, said the accounts for the year ended September 30th last showed a considerable improvement upon the preceding year, and this improvement applied both to the cooking and heating departments. The total increase in turnover was £32,000, which was the third largest turnover the concern had ever had in the 144 years of its existence as a firm and a company. During the whole of the year they had employed an average of sixty to seventy men and boys over the numbers of the previous year. The branch offices had had a good year. The turnover of the Wandsworth works was by far the largest the works had had since the war, and during the year they had made considerable extensions. They were at the present time getting out a new two or more unit electric range, which they believed would be on a competitive basis for large apparatus.

Enfield Rolling Mills, Ltd., held its annual meeting on December 20th at which the Earl of Verulam (chairman) announced an issue to shareholders at par of £200,000 4½ per cent. first mortgage debentures, redeemable by the operation of a cumulative sinking fund of 1½ per cent. per annum. The whole of the issue has been underwritten by the company's brokers for a commission of 1½ per cent. There was still a possibility of their being driven to recommend an extension in certain directions, which would mean further investment in plant and buildings of £50,000. The Enfield Cable Works charged them 5 per cent. on their loan and they found they could raise money on a debenture redeemable in so many years at a cheaper rate. Generally speaking, the directors considered that the company had now reached the profit-earning stage.

The British Vacuum Cleaner & Engineering Co., Ltd., held its annual meeting on December 20th, when Mr. H. C. Booth (chairman and managing director) said that the company had had another record year's trading, both as regarded turnover and profit. Their staff had been substantially increased and employment had been found for 500 extra people. In addition to their "Goblin" domestic cleaners, the turnover of the power plant section had also materially increased during the past year. Since the close of the year their turnover had still further increased, rendering it necessary to make further provision of manufacturing facilities.

The Oxford Electric Co., Ltd., proposes to make a capital return to ordinary shareholders of 10s. per £1 share, and to make a bonus payment out of profits of 7s. 6d. per share. The then 10s. shares will be consolidated into £1 shares (two 10s. shares per £1 share), and the capital increased to its former amount of £350,000 by the creation of 250,000 new ordinary £1 shares. It is also intended to repay preference shareholders the face value of their holdings and a bonus of 2s. 6d. per share. They will also be given the option on the new £1 ordinary shares at 25s. each at the rate of one ordinary for every three preference shares held. The proposals will be submitted at an extraordinary meeting to be held on January 11th next in Oxford.

Turner & Newall, Ltd., report a net profit for the year ended September 30th last of £714,228, as compared with £406,656 in the preceding year; to this is added £106,126 brought in, making £820,354. It is proposed to pay a final ordinary dividend of 7½ per cent., making 10 per cent. for the year (against 5 per cent.), and to carry forward £130,513. The report states that progress has been apparent in every section, and the company has been able to take the fullest advantage of the improvement in trading conditions. Meeting: January 17th at York.

Companies Struck Off the Register.—The names of the following companies have been struck off the Register, and they are thereby dissolved:—County Electrical & Wireless Stores, Ltd.; Radio Electric Co. (Bournemouth), Ltd.; Union Electric Co., Ltd.; Wynsor Electric Range Co., Ltd.; Electronos, Ltd.; Midways Electric, Ltd.; Pearsons Electricals, Ltd.; West Sussex Electrical Co., Ltd.

The Victoria Falls & Transvaal Power Co., Ltd., announces that it intends to pay off the whole of the 5½ per cent. second mortgage debentures outstanding, whether of series "A" or "B," at the rate of 103 per cent. on July 1st next. As already announced, the outstanding 5 per cent. debentures are being paid off at 110 on January 2nd next.

The Rio de Janeiro Tramway, Light & Power Co. has given notice that the first mortgage thirty-year 5 per cent. bonds which mature for payment on January 1st next will be paid on that date. The outstanding amount of the bonds is $19,756,600.

Telephone Rentals, Ltd., has announced an interim dividend of 3½ per cent. (same).

Electric Heating Elements. By A. G. Powell, A.M.I.E.E.

BY far the most common materials in use at present for the construction of heating elements are the nickel-chrome and nickel-chrome-iron alloys. Others are metallic and carbon substances compressed into refractory slabs, and silicon-carbide compounds in the form of rods. The last mentioned group is usually only employed for special purposes and has the disadvantage of brittleness. In order to obtain mechanical strength the rods should be of considerable cross-section, and are therefore most suitable for use with large currents and low voltage. It would seem that there is scope for considerable development in this direction. The second group is much employed for medium and low temperature applications, such as panel heaters.

The particular advantage of the nickel-chrome alloys, apart from mechanical characteristics at high temperatures, follows from the formation of an oxide film on the surface of the metal when heated, this film protecting the element from further oxidation to a great extent. The film is tenacious and does not flake off readily under conditions of the alternate heating and cooling to which elements are subjected. Flaking to some degree is bound to occur, of course, owing to the different rates of expansion of the metal and the scale, and the consequent cracking of the latter. In many cases, ready oxidised tape or wire is used for the manufacture of elements, this having the advantage that there is no appreciable change in the resistance of the elements due to oxidation on first switching on.

In use, the thickness of the oxide coating increases gradually until the element finally fails owing to the reduction of the thickness of the metal due to the continuous process of the flaking-off of the scale and the re-oxidation of the metal surface.

The nickel-chrome alloys are generally used for the higher temperatures and nickel-chrome-iron when a medium temperature only is attained by the element. The oxide coating formed on the latter is partly composed of iron oxide, and is neither so tenacious nor so resistant to the penetration of oxygen. The limit of the practical working temperature of nickel-chrome-iron elements is about 850 deg. C., but even under these conditions their life is shorter than that of elements made of nickel-chrome. The actual working temperature of the elements of most ordinary heating apparatus is between 800 and 900 deg. C. Nickel-chrome alloys are usually in the proportion of 80/20 and nickel-chrome-iron 65/15/20.

Wire and tape wound elements can be divided into open spiralled, mica wound, and embedded types. The first is principally employed for radiators, bowl fires, and other radiant heat apparatus. The composition and design of the refractory supports is of the greatest importance. Certain alkali salts combine, when heated, with the protective oxide film, the resultant substance having a low melting point. This results in the formation of a "hot-spot" and the consequent early failure of the element. Local overheating may also be caused by the design of the supports, which may prevent the free circulation of air round the element at particular points.

With all enclosed elements an essential of design is provision for the adequate conduction of heat away from the element. The mica-wound type is common to a large number of heating appliances, The resistance tape or wire is wound on and insulated with mica, the whole flat assembly being clamped to the metal to be heated. The efficiency of the thermal conductivity between the element and the actual heat dissipating surface must be as good as possible. This means that the element must be so clamped as to be in intimate contact with the metal, even when slightly distorted as the result of heat, and that the section of the metal should be adequate for the conduction of heat to the dissipating surface. The electrical connections to this type of element are usually made by riveting a nickel ribbon to the ends of the element winding.

Embedded elements are widely used for hot-plates and similar applications. They are usually spiralled and buried in refractory cement in grooves in the metal base, the cement serving both to electrically insulate the element and to provide a heat conducting medium between the two, with the advantage that air is excluded from the element. Refractory cements for this purpose have been the subject of considerable research, the object in view being the finding of a suitable material having good electrical insulating properties together with a high thermal conductivity. Connections to the element are generally made by brazing the leads and are usually of stranded chrome or nickel-chrome wire.

Combating Electrical Fires. By "F. S."

THE extinction of fires of an electrical origin demands measures additional to those usually employed in fire-fighting. Water, of course, is highly dangerous, and sand, though useful, must be used with discretion.

Extinguishers suitable for use in such cases include the carbon tetrachloride apparatus, which is usually in the form of a cylindrical vessel, the liquid being ejected by means of a double-action pump running through the middle. Different types are available, ranging from one pint to one gallon capacity. C.T.C. is a non-conductor and is non-injurious to insulating material; on reaching the seat of fire the liquid breaks down and forms phosgene gas, which is heavier than air and will not support combustion; the effect is to "blanket" out the fire. On small fires such an extinguisher achieves good results and it is clean in use. The refills are rather expensive, but should the fire be extinguished with a few "shots" there is no need to waste the rest of the contents. As the "blanketing" effect is due to the production of a gas which is liable to be dispersed by a current of air, however, such an extinguisher is not so suitable in the case of a fire consisting of closely packed smouldering material, such as stator or armature windings, which hold a considerable amount of inflammable dust. Furthermore, the gas produced is poisonous, and great care must be exercised.

The Foam Type Extinguisher

One of the best all-round extinguishers, either from the point of view of efficiency or the cost of recharging, is the foam-producing type. The sizes range from one gallon to thirty-four gallons, the larger ones being mounted on wheels. The expansive ratio is such that a one-gallon extinguisher produces about eight gallons of foam, and so on. The extinguisher proper consists of two cylindrical chambers, the inner one containing a weak acid and the outer an alkali solution. On releasing a valve and inverting the extinguisher, the two solutions are brought into contact with one another, the resulting reaction producing a foam and also liberating CO_2 gas, which sets up a pressure in the closed space of the extinguisher and thus expels the foam. The solution also incorporates a "stabiliser." This toughens the bubbles containing the CO_2 gas, and so produces a dense foam which effectively resists the heat produced by burning materials, oil, &c. A jet of foam from an extinguisher is non-conductive, although in the mass it has conductive properties. The following tests by a manufacturer bear out the above statement:—

A two-gallon extinguisher was operated by hand, no precaution such as wearing gloves being taken, and the jet directed upon a metal plate carrying 33,000 V. The operator was only 5 ft. from the plate.

An arc was made across two pieces of cable, the voltage being 12,000 V at 1.6 A, rising to 35 A. A one-gallon extinguisher was brought into operation and the arc was extinguished. The operator approached within 5 ft. of the cables, with the jet trained upon them and, although no precautions were taken, he did not feel the slightest shock.

The foam-type extinguisher has quite a number of points in its favour. The foam produced does not injure insulation and, furthermore, no noxious fumes are given off.

Generating Gas "Blankets"

Methyl bromide extinguishers are little used in the industrial world, although use is made of them on aircraft work. The steel cylinder contains liquid methyl bromide under pressure. At atmospheric pressure the liquid changes into a gas, so that on releasing a valve a non-combustible gas is discharged which is heavier than air, the effect being to smother the fire. On small fires such an extinguisher is efficacious and clean in operation.

The carbon dioxide extinguisher operates on the same principle as that of the methyl bromide type, the steel cylinder containing liquid CO_2 gas under pressure which, on release at atmospheric pressure, produces a heavy cloud of fire-extinguishing gas. For electrical work the CO_2 system is quite suitable, being clean and leaving no after effects; no noxious fumes are emitted. Such extinguishers are rated according to the storage capacity of the cylinders, *i.e.*, 7 lb., 12 lb., &c., the larger ones being mounted on wheels, and all are provided with a fan-shaped fibre nozzle.

On fires involving telephone switchboards, and similar apparatus, having a large number of small contacts and light leads, portable CO_2 extinguishers are invaluable. This system is also applied for the protection of power stations and other buildings housing a large quantity of valuable electrical gear. Batteries of CO_2 cylinders are assembled and the gas directed, when necessary, to various parts of the building by means of a permanent pipe-line system, various systems of automatic releases being employed. Carbon dioxide has a higher dielectric resistance than air, and easily overcomes any arcing.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

5938. "High-frequency inductance coils." H. Vogt. February 27th, 1933. (420226.)

7837. "Method of modulating light for the photo-electric impression of light for the sound on a photo-sensitive surface." A. Laffon & Soto and E. de Selgas y Marin. June 14th, 1932. (Cognate application 7838/33.) (420148.)

12342. "Electric motor control systems." International General Electric Co., Inc. April 27th, 1932. (Cognate application 12343/33.) (420294.)

14204. "Auxiliary switch devices." E. Assmann, P. Hochkopper, and O. Winkel. May 16th, 1933. (420227.)

14401. "Decorative lighting fittings." General Electric Co., Ltd., and F. Winstanley. May 18th, 1933. (420154.)

14911. "Electric heaters for use in connection with hair-waving." M. Calderon. May 23rd. 1933. (420229.)

15017. "Alternating-current dynamo-electric machines." British Thomson-Houston Co., Ltd. May 25th, 1932. (420230.)

15038. "Electric motor control systems." A. Stubbs, J. F. Perry, S. Stucken, and Associated Electrical Industries, Ltd. May 24th, 1933. (420435.)

15043. "Ignition devices for mercury-vapour electric convertors." General Electric Co., Ltd., and E. Gallizia. May 24th. 1933. (420231.)

15169/70. "Means for controlling electric circuits." British Thomson-Houston Co., Ltd. May 26th. 1932. (420299/420300.)

15297. "Voltage measuring and indicating devices." Marconi's Wireless Telegraph Co., Ltd., and R. H. P. Collings. May 26th. 1933. (420234.)

15390. "Direct-current dynamo-electric machines." G. M. Pestarini. May 27th, 1933. (420167.)

15463. "Means for obtaining constant voltage from variable-speed dynamos." Dynamic Devices, Inc. June 3rd, 1932. (420304.)

15464. "Means for obtaining constant voltage from variable-speed dynamos." Dynamic Devices, Inc. October 29th, 1932. (420305.)

15485. "X-ray apparatus." British Thomson-Houston Co., Ltd. May 28th, 1932. (420438.)

16002. "System for the transmission of electric waves along a dielectric guide." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). June 2nd, 1933. (420447.)

16487. "High-tension electric cables." Naamlooze Vennootschap Hollandsche Draad-en Kabel-Fabriek. July 6th, 1932. (420240.)

18202. "Electric metering devices." L. C. Benton, C. Ryder, and Associated Electrical Industries, Ltd. June 26th, 1933. (420176.)

18556. "Pupinised marine cables of high-damping." Siemens & Halske Akt.-Ges. June 30th, 1932. (420179.)

18760. "Wall boxes for switches or other electrical apparatus." H. B. Prentice. July 3rd, 1933. (420455.)

19105. "Alternating-current signal receivers." L. E. Ryall. July 5th, 1933. (420387.)

19278. "Electric starting systems for internal-combustion engines." J. Bohli. July 14th, 1932. (420388.)

19502. "Electric circuit-breaking apparatus." G. B. Ellis (Metropolitan Device Corporation). July 10th, 1933. (420182.)

19958. "Apparatus for measuring or indicating the power factor of an alternating-current supply system." Elliott Bros. (London), Ltd., and G. F. Shotter. July 14th, 1933. (420389.)

20193. "Microphone." G. Neumann. July 16th, 1932. (420390.)

20410. "Television systems." Marconi's Wireless Telegraph Co., Ltd. July 19th. 1932. (420391.)

20425. "Electrically heated apparatus." Rheinisch-Westfälisches Elektrizitätswerk Akt.-Ges. June 17th, 1933. (420392.)

21269. "Signalling or alarm devices for warning traffic." General Electric Co., Ltd., and E. G. Willmer. July 28th, 1933. (420393.)

21861. "Thermionic valves." Ferranti, Ltd., R. W. Sutton, and A. L. Chilcot. August 3rd, 1933. (420245.)

22980. "Electrical plug-and-socket connections." P. O. Dorer. August 17th, 1933. (420460.)

23091. "Production of nickel by electrolytic deposition from nickel-salt solutions." Falconbridge Nikkelwerk Aktieselskap. September 3rd, 1932. (420248.)

23842. "Clips for making electrical connections." S. J. Corbin. August 28th, 1933. (420398.)

25320. "Small synchronous motor." Landis & Gyr Akt.-Ges. November 24th, 1932. (420400.)

25893. "Process of and apparatus for the electrical separation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Siemens-Lurgi-Cottrell) Elektrofilter Ges. für Forschung und Patentverwertung). September 19th, 1933. (420192.)

26803. "Process of preparing and stabilising electroplating solutions and apparatus for use in connection therewith." R. E. Close. September 29th, 1933. (420402.)

28954. "Electric lighting fittings." General Electric Co., Ltd., and J. M. Waldram. October 19th, 1933. (420254.)

29876. "Electrical filter circuits." General Electric Co., Ltd., and L. I. Farren. October 27th, 1933. (420255.)

30075. "Remote-control systems for electric supply networks." E. Hallowell and Northern Utilities Trust, Ltd. October 30th, 1933. (420405.)

33834. "Electric heating devices." C. B. Backer. February 14th, 1933. (420467.)

34812. "Cooling dynamo-electric machines on aircraft." Fairey Aviation Co., Ltd., and A. G. Forsyth. December 11th, 1933. (420260.)

35871. "Intercommunication telephone system." W. C. Davey. December 20th, 1933. (420261.)

36178. "Electrically heated furnaces for heating metal sheets and the like." Akt.-Ges. Brown, Boveri et Cie. December 22nd, 1932. (420468.)

1934

3964. "Electrical plate condensers." R. Bosch Akt.-Ges. February 15th, 1933. (Cognate applications 3985/34 and 3986/34.) (420412.)

5146. "Sparking plugs." R. Bosch Akt.-Ges. March 2nd, 1933. (420415.)

6132. "Electrodes for arc-welding." R. Sarazin. February 25th, 1933. (420474.)

6468. "Electric hand-lamps for signalling and other purposes." H. W. Howe. May 29th, 1934. (420206.)

6611. "Detector circuits." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 29th, 1933. (420476.)

8768. "Electrical membrane sound-emitters." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken. June 15th, 1933. (420477.)

10108. "Television and like transmitting apparatus." Marconis' Wireless Telegraph Co., Ltd. March 30th, 1933. (420479.)

10266. "Automatic electric overload switch." E. Zahradnik, O. Lant and H. Hitschmann. February 14th, 1934. (420480.)

10591. "Electric soldering irons." E. Kramberger and V. Kaplan. April 11th, 1933. (420482.)

10782. "Electrical soldering irons." E. Kramberger and V. Kaplan. April 10th, 1934. (Addition to 420482.) (420483.)

11654. "Heterodyne electromagnetic wave receiving devices." Telefunken Ges. für Drahtlose Telegraphie. April 19th, 1933. (420417.)

12200. "Gasfilled electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 22nd, 1933. (420484.)

12348. "Radio receiving apparatus." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 6th, 1933. (420214.)

14038. "Sheathed electrodes for electric-arc welding." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken. December 29th, 1933. (Addition to 404500.) (420277.)

16932. "Circuit-arrangements comprising gasfilled electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 24th, 1933. (Cognate application 16933/34.) (420487.)

17212. "Trunk-communication cable installations." Siemens & Halske Akt.-Ges. June 10th, 1933. (420488.)

18018. "Developing-frame for X-ray images." C. H. F. Muller Akt.-Ges. June 20th, 1933. (420280.)

18547. "Projection arc-lamps." Zeiss Ikon Akt.-Ges. July 1st, 1933. (420493.)

18608. "Electric trolley vehicles." Maschinenfabrik Oerlikon. July 8th, 1933. (420220.)

19288. "Protection devices for electrical discharge vessels, particularly rectifiers." Siemens-Schuckertwerke Akt.-Ges. September 7th, 1933. (420282.)

19494. "Reverse-current electromagnetically-released electric switches." British Thomson-Houston Co., Ltd. July 1st, 1933. (420495.)

20123. "Gaseous electric discharge devices." British Thomson-Houston Co., Ltd. July 13th, 1933. (420497.)

22194. "Electric discharge devices." General Electric Co., Ltd. September 7th, 1933. (420499.)

22549. "Electric converting systems." British Thomson-Houston Co., Ltd. August 2nd. 1933. (420287.)

25343. "Incandescent cathodes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 7th, 1933. (420289.)

32942. "Method for the manufacture of magnetic cores for radio coils." H. Vogt. February 27th, 1933. (Divided application on 420226.) (420358.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 19th :—

Kador. No. 554518. Class 8. Electric batteries (not for medical purposes).—Vidor, Ltd., West Street, Erith, Kent.

Hornet. No. 554798. Pashometer. No. 544799. Class 8. Scientific apparatus for measuring the intensity of electric radiation from the human person.—R. W. J. Mackay, 506, Stafford House, Norfolk Street, Strand, W.C.2.

Biconite. No. 555637. Class 8. Electric cables and flexibles. No. 555638. Class 40. Wire insulated or sheathed with india-rubber and used for electrical purposes.—British Insulated Cables, Ltd., Prescot, Lancs.

Serity. No. 555203. Class 13. Electric lamps (ordinary), earthing clips for use in radio-telephony, electric switches (ordinary), and electric lighting, heating, and power fittings.—The Security Clip Co., Melandra Works, Brookfield, Glossop, Derbyshire.

Vulcan. No 555118. Class 13. Electric lamps (ordinary).—T. E. Maxfield & Co., 11, Westfield Terrace, Sheffield.

Faradex. No. 552583. Class 16. Electrical insulators made of porcelain or earthenware.—Steatite & Porcelain Products, Ltd., Bewdley Road, Stourport, Worcs.

Broadcaster Plus-a-Gram, &c. (lettering and design). No. 552944. Class 8. Apparatus for use in conjunction with radio receiving sets whereby sound from gramophone records may be reproduced through the radio apparatus.—J. & A. Margolin, 112-116, Old Street, E.C.1.

Homer (lettering and design). No. 553720. Class 8. Electric batteries (not for medical purposes).—Godfrey Holmes Tyre Co., Lincoln Road, Wragby, Lincoln.

Salora. No. 554221. Class 8. Searchlight apparatus and lamps for scientific purposes.—Salora Lights, Ltd., 52-53, Guildhall Buildings, Navigation Street, Birmingham.

Kallodent. No. 553655. Class 50. Synthetic resin sold in shaped pieces for industrial purposes.—I.C.I. (Fertiliser & Synthetic Products), Ltd., Imperial Chemical House, Millbank, S.W.1.

North-East Coast Institution Jubilee

November 28th was the fiftieth anniversary of the inaugural meeting of the North-East Coast Institution of Engineers and Shipbuilders (incorporated in 1914), and to celebrate the jubilee the Council has decided to hold a series of functions in the form of a summer meeting in June or July next.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abbots Langley (HERTS).—Houses (1,200), Ridgehurst Estate; E. A. Cragg, Watford R.D.C. surveyor.

Acton.—Baths, The Vale; borough engineer. Five factories, offices, &c., Gorst Road, Chase Road, Standard Road, Park Royal Road and Western Avenue; F. E. Simpkins, architect. Factory, Bashley Road; A. Sutton & Partners, on behalf of Universal Soap Co., Ltd. Shops and flats, Horn Lane; J. Brown & A. E. Hanson, on behalf of City Housing Trust, Ltd.

Ayr.—Houses (800), five years' plan; burgh surveyor.

Ayrshire.—School extensions, Galston (£11,500), for County E.C.; director of education, Ayr.

Barnes (SURREY).—Extensions to Isolation Hospital, Mortlake; F. P. Kindell, borough engineer.

Barnsley.—Public baths (£36,500); borough surveyor.

Barrow-in-Furness.—Church of St. John the Evangelist (£3,000); Rev. Norman A. Lesser, vicar.

Bath.—Houses (128); city engineer.

Bonchurch (I.O.W.).—Houses (30), Ledgings Estate (electrical work); Vernon Aldridge, architect, Ocean View Terrace, Ventnor.

Bournemouth.—Houses and flats, Bascott Road, etc.; W. J. Clapcott. Cinema, Wimborne Road; W. J. Mackeen. Hall, sports centre, etc., Winter Gardens site (£80,000); borough engineer. Addition to Royal Victoria and West Hants Hospital, Shelley Road; Hospital Board of Management. Reconstruction of Wimborne Road (£22,240); borough engineer.

Bradford (YORKSHIRE).—Houses (138), Cross Lane, Tong; Harry Emmott, Ltd., builders, 14, King's Arcade, Market Street. Houses (35), Thornton Road and Thornton Old Road; Holdsworth & Raistock, builders, Thornton Old Road. Houses (138), Bolton Road; Rufus North & Co., builders, 145, Idle Road, Undercliffe.

Brighton.—Buildings, Princes Place, North Street; Braybons, Ltd. Theatre for amateurs (£20,000); A. Melville.

Bromley (KENT).—School and medical clinic, Prince's Plain (£16,147), for Borough E.C.; director of education.

Burton-on-Trent.—Houses (200), Stapenhill; borough surveyor.

Calne.—Houses (28), Priestley Grove; borough surveyor.

Carlisle.—Central schools, Swifts site, for City E.C.; director of education.

Chester.—Houses (228), Lache Estate; city engineer. Houses, Woodlands Avenue; E. C. James. Block of shops, offices, and maisonettes (electrical work), St. Werburgh Street; Maxwell Ayrton, architect, 7, Grosvenor Street, London, W. News cinema, Swan Court, Foregate Street; C. W. Fennell.

Chichester.—Houses (36), Fulbourne, and electricity offices and showrooms; city surveyor.

Congleton.—Houses (50); borough surveyor.

Corby.—Council school (£25,600); A. Richmond & Sons, Retford.

Coulsdon.—Houses (286), Purley Estate; J. Laing & Son, Ltd. Library; U.D.C. surveyor.

Dartford.—Houses (118); W. J. Draper & Sons, builders. Houses (28); David Kenn & Sons, Ltd., builders, Bexley.

Denbighshire.—School, Abergele, for County E.C.; J. C. Davies, director of education, Wrexham.

Devonshire.—School, Coombe Martin, for County E.C. Junior school, Hayes Road, Paignton; county surveyor.

Ealing.—Houses (64) in three roads; E. B. Burge, Ltd., Woodstock Road, Wembley. Houses (46), Western Avenue; R. Lancaster & Sons, 30, Ealing Road, Wembley. Factories, Bideford Avenue, for Evesham Engineering Co., and for Hall & Spink; Percy Bilton (Properties), Ltd., 113, Park Street, W.1.

Earlestown.—Cinema; Foden, Hemm & Williams, architects, Century Buildings, 199, Deansgate, Manchester.

East Lothian.—Alterations and additions to County Infectious Diseases Hospital, Haddington (£25,300); county clerk, Haddington.

Falmouth.—Aerodrome; borough engineer and Truro borough engineer.

Fareham.—Electricity showrooms; H. T. Privett, U.D.C. surveyor, Westbury Manor.

Fifeshire.—Infectious diseases hospital, Cameron, near Thornton (£40,000); Dr. Pratt Yule, county m.o.h., Cupar.

Forest Hill.—Flats, swimming pool, &c.; Bertram Carter & Sloot.

Guildford.—Houses (80), Barnett Hill; A. Parsons, Bramley. Library, North Street; borough engineer. Senior boys' and girls' schools, Stoughton, for E.C.

Halifax.—Three-storey building, West Parade, for G. H. Gledhill & Sons, Ltd., Trinity Works; Pickles Bros. (builders), Ltd., Mile Thorn.

Hamilton.—Houses (808); burgh surveyor.

Hanley (STAFFS).—Houses (34), Belmont Road, Etruria; Lorne Estates, Ltd.

Harpenden.—Public offices (£12,000); W. H. Johnson, U.D.C. surveyor.

Hastings.—Laundry, Battle Road, for Advance Laundries, Ltd.; R. Hinds, architect, 8, Duke Street, London, W.C. Laundry and nurses' home, for Buchanan Hospital Governors; H. Ward, Son & Wray, architects.

Hereford.—Houses, Ross Road; C. Jewell & Son, builders.

Herne Bay.—Shelters, conveniences, &c., St. George's Parade; U.D.C. surveyor.

Hertford.—Houses (28), Prior's Wood site, Hertford Heath; housing architect.

Holmfirth.—Methodist church, Dunford Bridge (electrical and heating work); P. N. Brown, architect.

Hythe (KENT).—Houses (24); borough surveyor.

Jarrow-on-Tyne.—Houses (160), Monkton; J. Scott-Weir, borough engineer, Town Hall.

Kendal.—Houses (100), Glebe Fields; F. W. Oxberry, borough surveyor.

Kidderminster.—Shops and showrooms, Vicar Street, for England & Sons, 234, Bradford Street, Birmingham; Pritchard, Godwin & Clist, architects, Bank Buildings.

King's Lynn.—Houses (23), Saddlebow Road; Messrs. Mollekin.

Knottingley.—Houses, The Holes; U.D.C. surveyor.

Liverpool.—Printing Works, Hawthorne Road, Litherland, for J. H. Dewhurst, Ltd., Weddel House, West Smithfield, London, E.C.1; J. Gerrard & Sons, Ltd., builders, Swinton, Manchester.

Manchester.—Church, Moston Lane and Kenyon Lane, Moston, for Father Routledge, of St. Dunstan's, Bluestone Road; W. Telford, Gunson & Sons, architects, 10, Marsden Street.

London.—(BATTERSEA).—Houses, Stewart's Lane and Battersea Park Road; borough engineer. (BERMONDSEY).—Flats, Bryan's Court, Rotherhithe New Road, Southwark Park Road, and Tower Bridge Road, also additions to Neckinger depôt (£40,500); borough engineer. (HACKNEY).—Dwellings, Banbury Road (French Hospital site), (£59,000); L.C.C. architect. (PADDINGTON).—Reconstruction of North Wharf Road (£39,000); L.C.C. architect. (POPLAR).—Town hall; borough engineer. (ST. MARYLEBONE).—Shops and flats, Marylebone Road, &c.; T. P. Bennett & Son. Shops and flats, Wellington Road and Cochrane Street; S. B. Caulfield. (ST. PANCRAS).—R.C. school, Euston Road, Osnaburgh Street; R.C. authorities. (VAUXHALL).—Vauxhall Cross improvement scheme (£363,000); L.C.C. Highways Committee. (WESTMINSTER).—Buildings, 68-102, Knightsbridge; Gordon Jeeves. Central highways depôt; Grey Wornum, architect.

Middlesbrough.—Houses (130), Acklam Main Road; Kitching & Co., architects, 21, Albert Road. Houses (66), Mill Hill Estate; H. Waddington, builder, Daleston Avenue, Linthorpe. Alterations to Highfield Hotel; Kitching & Co., architects, 21, Albert Road.

Middlesex.—Road construction, Western Avenue (£351,000), and technical school, Greenford; county surveyor.

Morayshire.—School, Bishopmill, Elgin (£9,478); architect, County Council Education Committee.

Newcastle-on-Tyne.—Depôt, Ouseburn (£53,563); J. W. Steele, borough engineer, Town Hall.

Newport (I.O.W.).—New county offices (£63,591); Isle of Wight C.C. surveyor, and Gutteridge & Gutteridge, architects, Southampton. Extensions to secondary school (£8,325); Isle of Wight C.C. architect.

Northolt.—Shops and garages, Ruislip Road and Yeading Lane, for T. J. Allan; W. J. Ross, surveyor, The Estate Offices, Brent Station, Golders Green, N.W.11.

Northumberland.—Hospitals, Morpeth and Earsdon, for C.C.; W. W. Tasker, architect, County Hall, Newcastle-on-Tyne.

Penrith.—Houses (50), and clearance schemes; U.D.C. surveyor.

Portland.—Houses, Wakeham; W. F. Davies.

Raunds.—Houses (26), Crow Spinney; U.D.C. surveyor.

Richmond (SURREY).—Houses (88); borough surveyor. Houses (66); S. E. Moss & Sons, builders, Chelmsford.

Ruislip.—Extensions to Manor School (£7,164); G. H. Dibblin, Ltd.

Sanderstead (SURREY).—Houses (26), Barn Crescent; John Laing & Son, Ltd. Houses, Fox Farm, Selsdon Road; R. Costain, Ltd. Hospital, Limpsfield Road; U.D.C. surveyor.

Settle.—Houses (20), Cammock Lane and Skipton Road; G. F. Shackleton.

Somerset.—Schools, Frome, Martock, Wells, Weston-super-Mare, and Williton, for County E.C.

Staines (MIDDLESEX).—Widening of London Road (£22,577); county surveyor.

Stanley (CO. DURHAM).—Public baths; A. Routledge, surveyor.

Stirling.—Houses (102); burgh surveyor.

Stoke Newington.—Town hall, library, assembly hall, &c.; J. Reginald Truelove, architect.

Stoke-on-Trent.—Houses (292), Blurton Road, Blurton; Ball & Robinson. Houses (22), Trentham Road, Longton; Cooper & Jones.

Sunderland.—Cinema, Fulwell, for the Wearside Entertainments, Ltd.; P. L. Browne & Sons, architects, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne. Dance hall, Seaburn (£29,000); O. H. Mark, architect, Town Hall. Shops, Sea Road, Fulwell; W. Rutherford, builder, Mitford Street, Sea Road.

Swansea.—Houses, Lon Bryngwyn; S. D. Thomas. Houses, Wimmerfield Farm; S. Davies. Library, Dunns Lane; borough engineer.

Todmorden.—Houses (92), Ashenhurst Road; borough surveyor.

Tunstall (STAFFS).—Houses (80), Colclough Lane, Goldenhill; G. H. Wignall. Houses (29), Huntille Road; J. T. Nixon.

Ulverston.—Hospital, electrical work; S. Grundy, architect, Central Buildings.

Uxbridge.—Swimming baths, Hillingdon; borough architect.

Walsall.—Houses (324); borough surveyor. Houses (62), Barracks Lane, Blakenall (£16,368); L. G. Peace. Houses (300), Delves (South) Estate, and Woodward's Road, Pleck; borough engineer. Houses (26), Station Street, Bloxwich (£7,129); H. Lloyd, Walsall.

West Hartlepool.—Practical rooms, Elwick Road School; F. Durkin, borough engineer, Town Hall.

West Riding.—Senior school and caretaker's house, Normanton, for C.C.; J. Horkin & Sons, builders, High Town, Liversedge.

Weston-super-Mare.—Church (£13,316), electrical work; Bryant & Son, builders, Birmingham.

Wokingham.—Shops, Maiden Erlegh Estate; S. T. Cook.

Wolverhampton.—Houses (110), Low Hill Estate; A. M. Griffiths & Son.

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